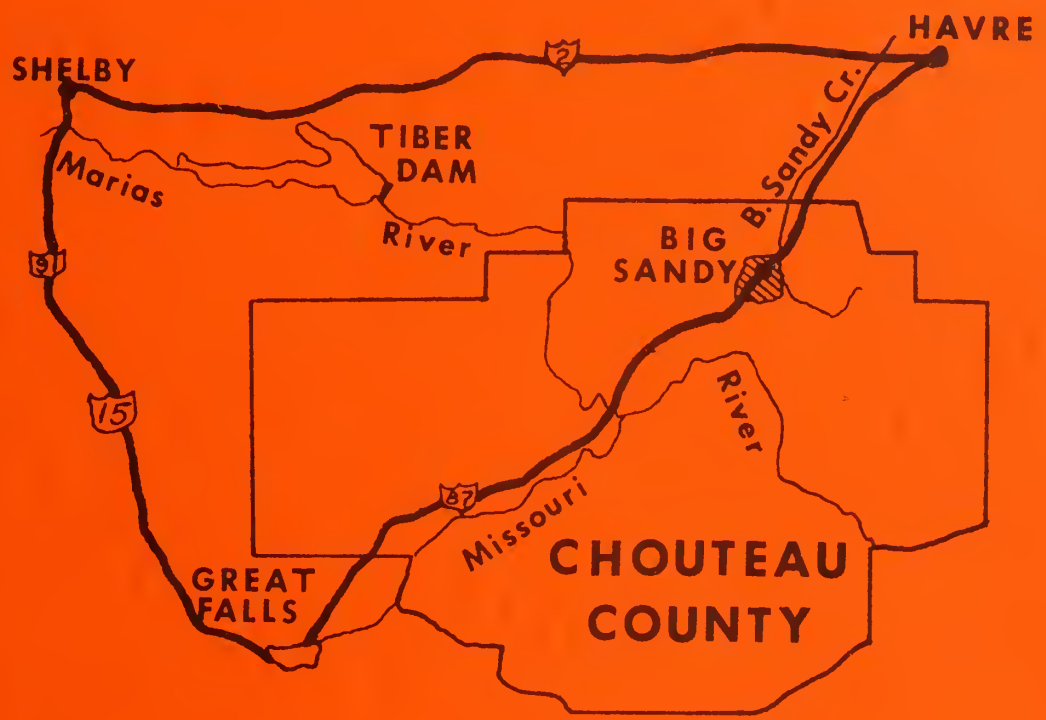
INTERPRETATIONS FOR COMMUNITY PLANNING IN BIG SANDY, MONTANA



Prepared by

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Bozeman, Montana
1967

OUR SOIL ★ OUR STRENGTH

SOIL SURVEY INTERPRETATIONS

for

COMMUNITY PLANNING

in

BIG SANDY, MONTANA

Prepared by

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY PARTY

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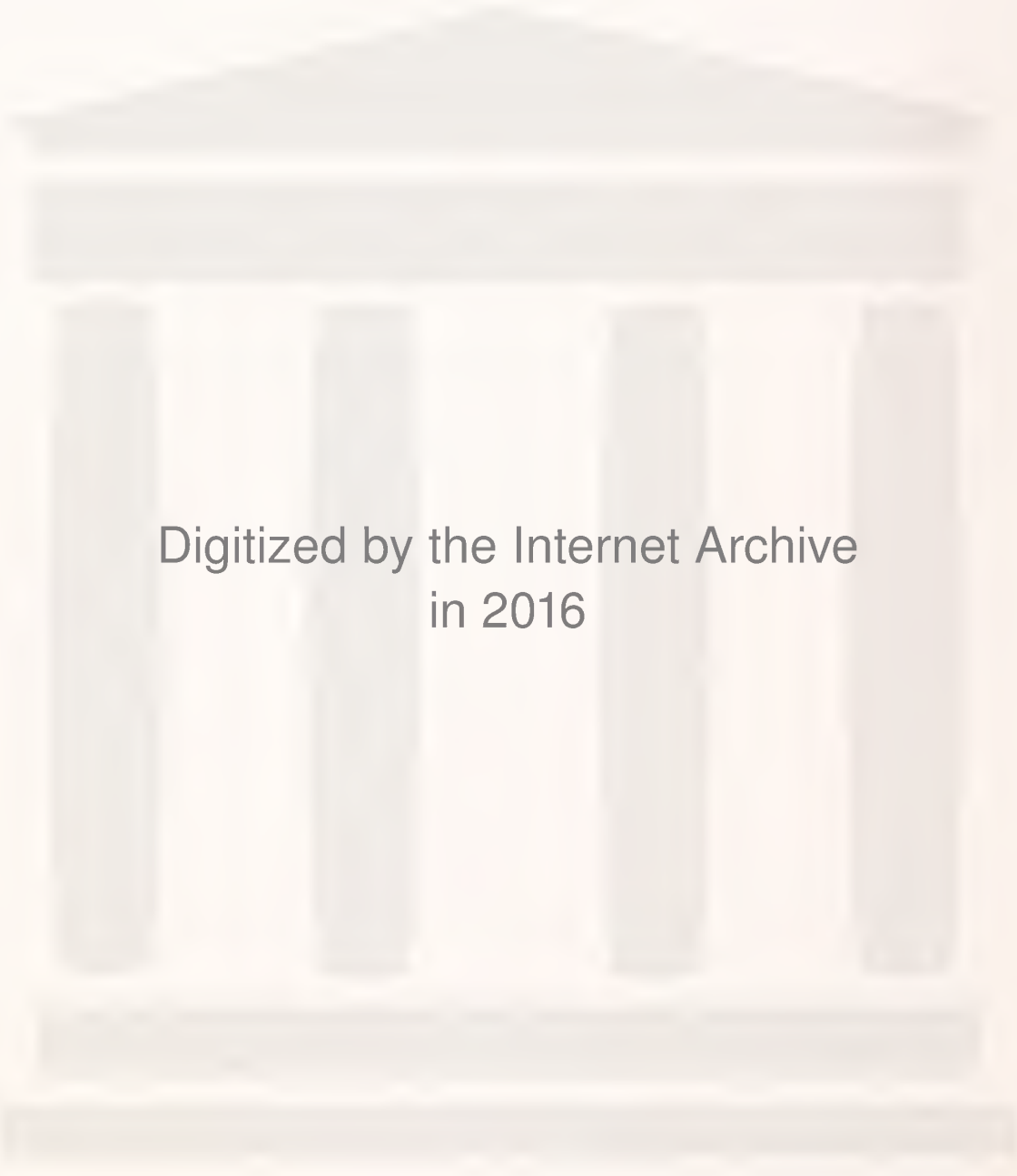
September 1967

ACKNOWLEDGEMENT:

Honorable Glenn Hymphrey, Mayor
Ray Amen, Councilman
Allen Adams, Pastor
Joe Trepina, Water Commissioner
Odin Svennungsen, Dry Cleaner Owner
Odin Blockhus, Postmaster
Don Courtnage, Businessman
Aaron Peterson, Bank Cashier
Big Sandy FFA Chapter



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FOREWORD

The Soil Conservation Service in the United States Department of Agriculture has been making soil surveys for over thirty-one years. Historically, these surveys were used primarily to guide proper land use in farm and ranch planning. Current trends and competitive use of our land have given soil surveys a much broader scope. Soil surveys of today are being interpreted for many uses and should be the basis for all land use decisions. They are multipurpose in character and designed for a wide variety of land use planners.

The soil survey for this community was made at the request of the City Council of Big Sandy, who asked for assistance through their local Soil and Water Conservation District. Soil scientists from the Soil Conservation Service made the survey along with volunteer labor and assistance from the community of Big Sandy.

This soils report and the interpretive maps will provide the community planners and developers with basic soils information that can help them to make wise land use decisions for the betterment of the community.

Properly used, this report can help the City Council, as well as all citizens of the community, in making Big Sandy a better place to live. Home owners, planning consultants, engineers and others can all benefit from a better knowledge of their basic resource--the soil. The interpretations given in this report will not eliminate the need for on-site soil investigations for specific design and construction.

The Soil Conservation Service gratefully acknowledges the assistance and support extended by the community of Big Sandy. It is the hope of the Service that all who are involved in land use decisions will consider the soil resource, the alternatives for its land use, and the needs of our people.

A. B. Linford

A. B. Linford
State Conservationist

SECTION I. THE SOIL SURVEY

Location and Extent

The community of Big Sandy is located in Chouteau County, Montana, approximately 81 miles northeast of Great Falls and 33 miles southwest of Havre on Highway 87.

This soil survey and report covers an area of 1640 acres. Approximately 270 acres are in the city limits of Big Sandy. The topography is nearly level to moderately sloping. There are short undulating slopes to the south, west, and north, forming a basin within the city limits. The drainage pattern consists of several small intermittent drainage courses leading into Big Sandy Creek, a perennial stream flowing to the north. Elevation ranges from a low of 2685 feet where Big Sandy Creek leaves the northeast corner of the survey area to a high of 2800 feet on the rolling slopes on the northwestern edge of the survey area.

Figure 1. Aerial view of Big Sandy showing new grade school in foreground. 1968 SCS Photo.

Climate and Geology

The climate is characterized by relatively low rainfall, hot summers, cold winters, and a large portion of sunny days. Annual precipitation at Big Sandy averages 12.06 inches. The heaviest rainfall is in late spring and early summer. Occasional heavy snows are recorded during the winter months. The maximum temperature on record is 109 degrees F. recorded in July. The coldest temperature on record is a minus 52 degrees F. recorded in February. The daily temperature fluctuations are greatest when the nights are cool and daytime temperatures reach 90 to 100 degrees F. The frost-free season averages 120 to 130 days. The last killing frost occurs in mid May and the first killing frost in early or mid September. Strong winds are common to the area and are more prevalent in the early spring. Hail storms occur in localized areas during the summer months.

The soils and physiographic features of the area are closely related. The alluvial soils occur on the nearly level flood plains of Big Sandy Creek. They consist of stratified clay, silt, and sand, and were deposited by flood waters. These soils are usually poorly drained. The slightly higher lying area on which the town of Big Sandy is built has a thin mantle of alluvium overlying a dense but unconsolidated glacial deposit. Associated with the glacial deposit along the west and north edge of town is a narrow ridge. This ridge has pockets of sand and gravel mixed with the silt and clay materials and is the only source of gravel near the city.

Figure 2. Soil profile of Hill loam with pockets of gravel occurring below 2 feet. SCS photo.

Needs and Methods

The Big Sandy City Council recognizes the need for and value of soils information as a base for planning future developments and improvements in the community. Because of inadequate surface drainage and adverse soil conditions, it has been difficult to maintain streets in this community. In some areas, soft spots and depressions make streets impassable in the spring or during wet weather. Locally, poor surface drainage and slow permeability of the soil causes surface ponding. Basements receive some seepage water where subsurface water moves laterally along the less permeable soil layers. In some areas, wetness and high salt concentrations have caused damage to concrete foundations, sidewalks, buried pipelines, and to shrubbery.

Figure 3. Temporary flooding and ponding from surface runoff during spring and summer causes damage and inconvenience to some home owners.

To help the community of Big Sandy with these problems, the City Council made a formal request to the Big Sandy Soil and Water Conservation District for assistance. They asked for a detailed soil survey and the soil interpretations that would help them in their future planning. At the request of the District, soil scientists from the Soil Conservation Service made a detailed soil survey on 1640 acres. The city of Big Sandy hired a backhoe and operator to dig 44 pits. These pits were of tremendous value for making detailed study of the soils and describing their characteristics. The pits varied in depth from 8 to 12 feet. They were located by the survey party leader and were representative of the most extensive soils in the area.

A pastor, postmaster, water commissioner, bank cashier, two businessmen, and the local Chapter of Future Farmers of America volunteered their assistance. They helped collect and label soil samples for laboratory analyses.

Figure 4. Future Farmers of America boys assisting SCS soil scientist with sampling and labeling soils for laboratory analyses. SCS photo.

Figure 5. Reverend Adam and Water Commissioner Trepina bagging soil samples for laboratory analyses. SCS photo 1967.

The State Highway Commission of Montana made laboratory analyses of these samples and furnished some of the data in evaluating the different soils for various uses.

Figure 6. Soil Scientist Clark examines the Rista soil in a pit excavated with a backhoe by the City of Big Sandy. Photo by Jeanne Wilson.

In the course of the survey, the soil scientists observed the depth of the soil and the thickness of each soil layer. They studied and recorded for each soil layer such characteristics as color, texture, structure, consistence, lime content, wetness, salts, and kinds and amounts of gravel. In addition to these soil characteristics, which identify each kind of soil, slope, past erosion and flood hazards were also considered.

How to Use this Report

The information in this report can be more easily understood by following a sequence of study.

First, examine the soil map on page 7. It shows the location and extent of each kind of soil. Cultural features such as roads, buildings and Big Sandy Creek are reference points which can help locate a particular tract of land. Many tracts of land will have two or more different kinds of soils within its boundary. Each delineation on the soil map is called a soil mapping unit and contains a map symbol by which it can be identified. All soil symbols on the map are defined in Table I. Identification Legend. It is important to know that boundaries between many soils are not sharp and that one kind of soil tends to grade into another which is joining it.

After finding the area of interest, identify the soil symbol and turn to the appropriate soil description. The soil description includes information about the composition of soils in the mapping unit and specific statements about the texture, color, structure, and depth. In studying the soil description, it should be understood there are ranges in characteristics of the properties of each soil. The properties described are most representative of the soil for that area. Within each mapping unit there are usually minor inclusions of other soils.

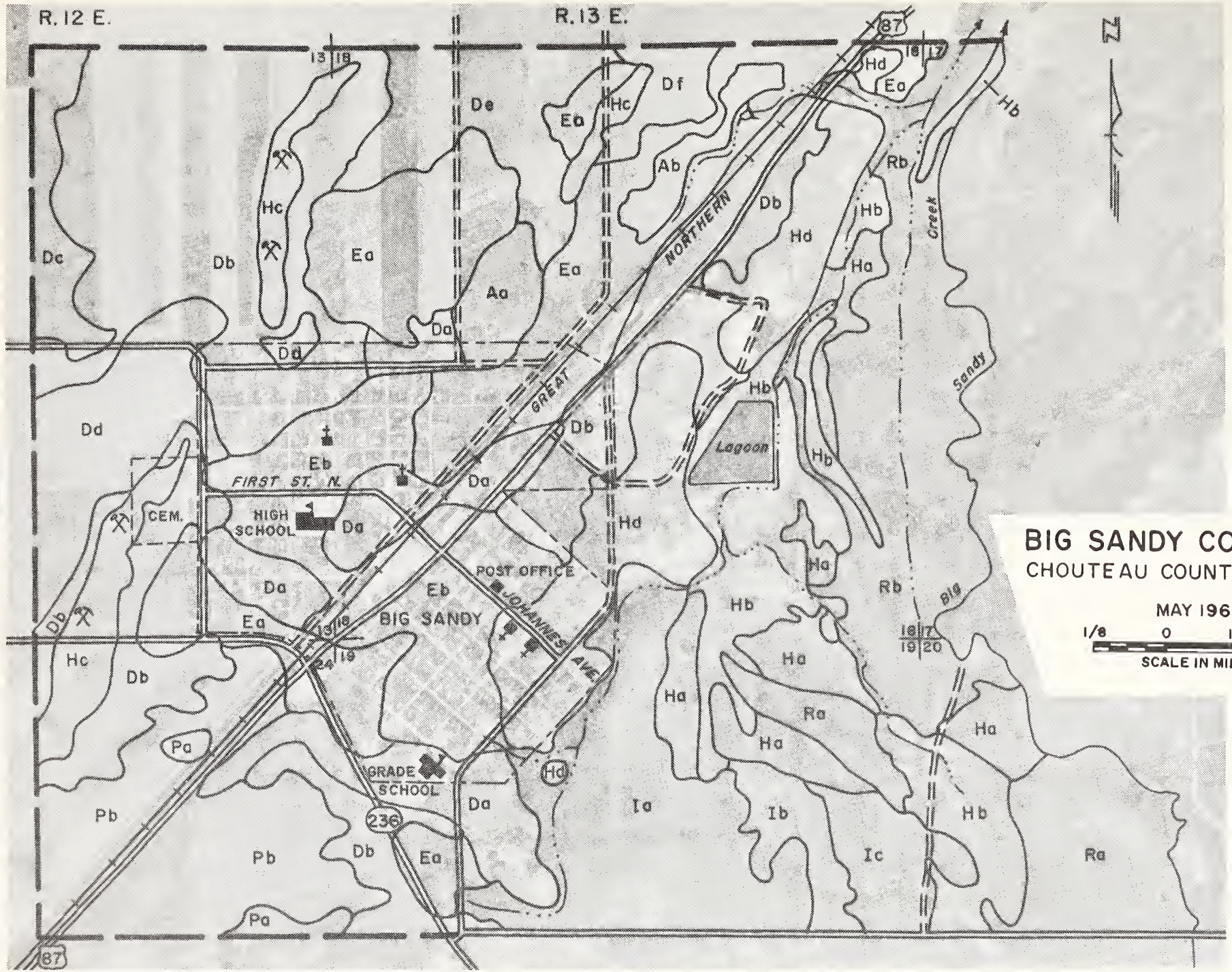
When the descriptions of mapping units have been studied, refer to the section on soil interpretations. Detailed information is given in this section on the limitations of the soils for alternative uses.

Names and Descriptions of Soils

There are twenty-one different mapping units on the soil map for the Big Sandy community. Each mapping unit is named in terms of the major soil series within its boundary. A soil series is a kind of soil that has similar characteristics and sequence of soil layers, or horizons, except for texture of the surface six inches of soil. The surface texture for the same soil may change because of tillage. All soil series names in this report are tentative and subject to change pending completion of a soil survey of Chouteau County. Soil series name changes will not affect the usefulness of the soil map or the interpretations that can be made from it.

Several of the mapping units described in this report consist of two or more kinds of soil that occur in intricate patterns and are not large enough to show separately.

The mapping units are listed alphabetically in the identification legend in Table 1. Following the identification legend is the description of each mapping unit. These descriptions emphasize the major soil properties that influence the behavior of the soil under alternative uses and kinds of management needed to protect the resource.



BIG SANDY COMMUNITY

CHOUTEAU COUNTY, MONTANA

MAY 1968

1/8 0 1/8 1/4

SCALE IN MILES

ADVANCE COPY - SUBJECT TO CHANGE

Table 1. Identification Legend - Mapping Unit Name and Approximate Acreage. (All soil names are tentative and subject to change)

Symbol	Soil Name	Acres	Percent
Aa	Absher-Devon, alkali variant, complex, 3 to 6 percent slopes	18	1.0
Ab	Absher-Nobe complex, 0 to 2 percent slopes	14	0.9
Da	Devon loam, 0 to 2 percent slopes	76	4.6
Db	Devon loam, 2 to 4 percent slopes	312	19.1
Dc	Devon loam, 4 to 8 percent slopes	21	1.3
Dd	Devon loam, thick solum phase, 0 to 1 percent slopes	50	3.0
De	Devon loam, alkali variant, 0 to 2 percent slopes	59	3.6
Df	Devon loam, alkali variant, 2 to 4 percent slopes	16	1.0
Ea	Emmer-Absher complex, 0 to 1 percent slopes	191	11.7
Eb	Ethridge clay loam, 0 to 1 percent slopes	102	6.2
Ha	Hagga loam, 0 to 1 percent slopes	59	3.6
Hb	Hagga loam, saline phase, 0 to 1 percent slopes	95	5.8
Hc	Hill and Tinsley soils, 6 to 20 percent slopes	45	2.7
Hd	Hill-Devon loams, 3 to 10 percent slopes	107	6.5
Ia	Ideon clay loam, 0 to 1 percent slopes	109	6.7
Ib	Ideon clay, alkali variant, 0 to 1 percent slopes	18	1.0
Ic	Ideon clay, sandy substratum phase, 0 to 1 percent slopes	25	1.5
Pa	Poser-Kerwin clay loams, 0 to 1 percent slopes	9	0.5
Pb	Poser, moderately well drained variant-Emmer loams, 0 to 1 percent slopes	110	6.8
Ra	Rista clay loam, 0 to 1 percent slopes	50	3.0
Rb	Rista clay loam, wet phase, 0 to 1 percent slopes	144	8.9
	Lagoon	10	0.6
	TOTAL	1640	100.0

Symbols Used on Soils Maps

Soil symbol and boundary: Soil symbol-----→ Aa ←--Soil boundary

(Aa Absher-Devon, alkali variant, complex, 3 to 6 percent slopes--The symbol "Aa" identifies the mapping unit. The black line that surrounds each symbol is the mapping unit boundary.)

Other boundaries, marks, and monuments:

City limits ___ _ ___ _ ___ _ ___

Cemetery CEM

Works of structures:

Good motor road ═══════ Hwy. 236 87

Poor motor road - - - - - - - - - - - - - -

Railroad +++++++++++

Cultural features significant for orientation:

Church

School

Gravel Pit

Drainage:

Perennial stream

Intermittent drainageway

Descriptions of Soil Mapping Units

(Aa) Absher-Devon, alkali variant, complex, 3 to 6 percent slopes--
This unit has two major soils that occur in an intricate pattern. It is impractical to make separation on the map with the scale used. The soils in this unit occur on gentle to moderate, irregular or undulating slopes. They are found in one area just north of Big Sandy. This unit consists mainly of two soils--Absher clay loam and Devon loam, alkali variant. The Absher soils comprise about 30 percent of the unit and are on the more concave portion of the landscape. The Devon, alkali variant, soils comprise approximately 50 percent of the unit. Small inclusions of several other soils that have only slightly different characteristics comprise up to 25 percent of the unit.

The Absher soils have a thin, grayish brown, mildly alkaline, loam surface layer about 4 inches thick. The subsoil to 18 inches is heavy silty clay loam with distinct prismatic or blocky structure. The soils below 18 to 24 inches are strongly alkaline clays that are very hard when dry and very slowly permeable. White flecks of segregated lime and gypsum are common in this layer.

The Devon, alkali variant, soils have a grayish brown, mildly alkaline surface layer about 6 inches thick. The subsoils to 12 inches are friable clay loam, with prismatic or blocky structure. Below 12 inches the soils become very strongly alkaline and loam or clay loam textures predominate. The Devon soils are slowly permeable except for thin lenses of fine sandy loam that transmit water laterally. This results in seepage in excavation and open cuts.

(Ab) Absher-Nobe complex, 0 to 2 percent slopes--
The soils in this unit are nearly level and occur only in one area northeast of Big Sandy. This unit consists mainly of Absher clay loam and Nobe clay. The Absher soils comprise about 50 percent of the unit and occupy the smooth, slightly elevated position. The Nobe clay soils comprise about 40 to 50 percent of the unit and occur on the concave positions which are nearly barren of vegetation. These two soils occur in an intricate pattern and it is not practical to separate them on the map at the mapping scale used.

The Absher soils have a thin, grayish brown, mildly alkaline, loam surface layer about 4 inches thick. The subsoil to 18 inches is a silty clay with distinct prismatic or blocky structure. The soil below 18 inches is strongly alkaline clay that is very hard when dry and very slowly permeable. White flecks of segregated lime and gypsum are common in this layer.

The Nobe clay soils have a very thin, light brownish gray surface layer which forms a hard crust when dry. The soil below 2 inches is a strongly alkaline clay that is very slowly permeable. The surface runoff from adjacent areas frequently ponds in these shallow concave positions.

(Da) Devon loam, 0 to 2 percent slopes--
This soil occurs on nearly level to very gently undulating slopes. In this unit Devon soils comprise about 85 percent of the area. Included are several other soils that have only slightly different characteristics. These comprise less than 15 percent of the unit.

The Devon soils have a grayish brown, friable loam surface layer about 6 inches thick. The subsoil to 12 inches is a friable clay loam with prismatic structure. The clay loam soil below 12 inches is strongly calcareous and segregated lime is common. Below 24 inches the soil is a friable clay loam with weak prismatic structure. This soil is underlain by a compact clay loam glacial till or lacustrine deposit at 40- to 60-inch depths. Within short distances the depth to the compact soil may vary as much as 2 feet. The soil permeability is moderately slow to the compact layer and slow below.

(Db) Devon loam, 2 to 4 percent slopes--
Soils in this unit are on gently sloping to gently undulating topography. Devon loam comprises 80 to 85 percent of the soils in this unit. Small inclusions of Hill loam on convex positions and Ethridge loam in some concave areas comprise less than 20 percent of the area. The inclusions of Hill and Ethridge soils are in areas less than 5 acres in size and in very irregular pattern.

The Devon soils have a grayish brown, friable loam surface layer about 6 inches thick. The subsoil to 12 inches is a friable clay loam with prismatic structure. The clay loam soil below 12 inches is strongly calcareous and segregated lime is common. Below 24 inches is a friable clay loam with weak prismatic structure. This soil is underlain by a compact clay loam glacial till or lacustrine deposit at 40- to 60-inch depths. Within short distances these depths may vary as much as 2 feet. The soil permeability is moderately slow to the compact layer. The compact layer below 30 inches is slowly permeable.

The Hill soils are calcareous and have a light colored, loam surface layer. The subsoil to depths greater than 6 feet have stratified, loamy textures with moderate permeability.

The Ethridge soils have a grayish brown, friable loam surface layer 6 inches thick. The subsoil to about 18 inches is friable silty clay with prismatic structure. Below 18 to 24 inches is a silty clay loam that is strongly calcareous and has common lime segregation. The lower subsoil at about 40-inch depths is more compact and slowly permeable.

(Dc) Devon loam, 4 to 8 percent slopes--
The soils in this mapping unit are similar to the Devon loam soils on 2 to 4 percent slopes (Db), except they are more sloping and moderately undulating. They occur mostly along the northwest edge of the survey area. Devon loam soil comprises 80 to 85 percent of this unit with minor inclusions of Hill loam on some convex positions. The Hill soils occur in areas less than 5 acres in size.

(Dd) Devon loam, thick solum phase, 0 to 1 percent slopes--
This soil is found on nearly level to slightly concave slopes. The soils in this unit differ from Devon loam in having the lime deeper in the profile. The Devon, thick solum, soils comprise about 80 percent of the unit. Small inclusions of Poser soils will not exceed 20 percent of the unit. The Poser soils occur in an irregular pattern and in small concave positions in areas less than 3 acres in size.

The Devon loam, thick solum, soils have a grayish brown, friable, loam surface layer about 7 inches thick. The subsoil to about 26 inches is a friable clay loam with prismatic structure. Below 26 inches the soil is strongly calcareous and has some segregated lime. Loam textures dominate this layer to a depth of about 60 inches, at which depth the soil is a compact clay loam glacial till. Permeability is moderately slow to 60 inches and slow in the compact glacial till below 60 inches.

The Poser soils have a light brownish gray loam surface about 7 inches thick that forms a crust when dry. The subsoil to 15 inches is clay texture with prismatic structure. The soil between 15 and 60 inches is strongly calcareous, heavy clay loam texture with blocky structure. The soil below 40 inches is strongly alkaline and slowly permeable.

(De) Devon loam, alkali variant, 0 to 2 percent slopes--
This soil is found north of Big Sandy on nearly level to very gentle slopes. Devon loam, alkali variant, makes up 85 to 95 percent of the unit. Absher clay loam soils occur in small, slightly concave positions throughout the unit in areas less than an acre in size.

Devon loam, alkali variant, has a grayish brown loam surface layer about 5 inches thick. The subsoil to about 11 inches is a friable clay loam with prismatic structure. Below 11 inches the soil texture is predominantly clay loam. It is very strongly alkaline and strongly calcareous with white flecks of lime, gypsum and salts. The soil below 11 inches is slowly permeable.

Absher soils have a thin, grayish brown, mildly alkaline, loam surface layer about 4 inches thick. The subsoil to 14 inches is a heavy clay loam with distinct prismatic structure. Below 14 inches is strongly alkaline clay loam or clay that becomes very hard when dry and is very slowly permeable.

(Df) Devon loam, alkali variant, 2 to 4 percent slopes--
This soil is found north of Big Sandy on gently sloping to gently undulating slopes. Devon loam, alkali variant, makes up 85 to 90 percent of the unit. Inclusions of Absher clay loam occur in small, slightly concave areas throughout the unit. These areas are less than an acre in size and comprise less than 15 percent of the mapping unit.

Devon loam, alkali variant, has a thin, grayish brown, loam surface layer about 5 inches thick. The subsoil to about 11 inches is a friable clay loam with prismatic structure. Below 11 inches the soil texture is predominantly clay loam. It is very strongly alkaline and strongly

calcareous with white flecks of lime, gypsum and salts. The soil below 11 inches is slowly permeable.

The Absher soils have a thin, grayish brown, mildly alkaline loam surface layer about 4 inches thick. The subsoil to 14 inches is a heavy clay loam with distinct prismatic structure. Below 14 inches is strongly alkaline clay loam or clay that becomes very hard when dry and is very slowly permeable.

(Ea) Emmer-Absher complex, 0 to 1 percent slopes--
The soils in this complex occur on nearly level terraces. They developed in strongly alkaline alluvium. This unit consists mainly of Emmer loam and Absher clay loam soils. The Emmer soils comprise about 50 percent of the unit and occur on the smooth, slightly elevated positions. The Absher soils comprise about 36 percent of the unit and are found on the smooth to slightly concave positions. Small inclusions of Nobe clay are found in the concave areas that are nearly barren of vegetation.

The Emmer soils have a grayish brown, friable loam surface layer about 6 inches thick. The subsoil to 20 inches is clay texture with prismatic structure. Below 20 inches the clay subsoil is strongly alkaline and strongly calcareous. Prominent flecks of lime and salt are visible. The surface layer of the Emmer soils absorbs water readily. The clay layer below 20 inches is very slowly permeable and temporary saturation causes the soil to remain wet for longer periods.

The Absher soils have a thin grayish brown, mildly alkaline, loam surface layer about 4 inches thick. The subsoil to 18 inches is a clay texture with distinct prismatic structure. The clay subsoil below 18 to 24 inches is very slowly permeable and strongly alkaline. It becomes very hard when dry and has white flecks of segregated lime and gypsum.

Nobe clay has a very thin, light brownish gray surface that forms a hard crust when dry. The soil below 2 inches is clay texture and very strongly alkaline. It is very slowly permeable and surface runoff from adjacent areas frequently ponds in these shallow concave positions.

(Eb) Ethridge clay loam, 0 to 1 percent slopes--
Soils in this unit are dominantly within the town site of Big Sandy and occur on nearly level to slightly concave slopes. Ethridge clay loam comprises about 80 percent of the unit. Small inclusions of Devon loam occur on slightly convex positions in areas less than 3 acres in size.

Ethridge soils have a grayish brown, friable, clay loam surface layer 7 to 10 inches thick. The subsoil texture to 15 or 18 inches is a clay loam with strong prismatic structure. Below 18 inches the clay loam texture is strongly calcareous and strongly alkaline. White flecks of segregated lime are easily seen. The soil permeability is moderately slow.

The Devon soils have a grayish brown, friable, loam surface layer about 6 inches thick. The subsoil to 12 inches is a friable clay loam with moderate prismatic structure. Below 12 inches the friable clay loam is strongly calcareous and has weak prismatic structure. This soil is underlain by a compact clay loam glacial till or lacustrine deposit at 40- to 60-inch depths. The soil is moderately permeable to the compact layer slowly permeable below.

(Ha) Hagga loam, 0 to 1 percent slopes--
This soil occurs on the nearly level to very slightly undulating flood plain of Big Sandy Creek. It is subject to frequent overflow during periods of runoff. The Hagga loam comprises 80 to 85 percent of the unit. Minor inclusions of Ideon clay loam occupy long, narrow, slightly concave areas that are less than 5 acres in size.

The poorly drained Hagga soils have a grayish brown, friable, loam surface layer about 5 inches thick. The subsoil to about 48 inches is stratified loamy textured and is calcareous and moderately alkaline. Yellowish brown mottles associated with restricted drainage are common in the subsoil. The soil below 48 inches is dominantly very slowly permeable clay that is strongly alkaline.

The Ideon soils have more clay throughout the profile than the associated Hagga soils.

(Hb) Hagga loam, saline phase, 0 to 1 percent slopes--
This soil occurs on the very slightly undulating flood plain of Big Sandy Creek and is subject to frequent overflow during periods of runoff. The Hagga soils in this unit are strongly saline and comprise about 80 percent of the unit. Minor inclusions of Ideon clay loam occur in long, narrow, slightly concave areas which are less than 3 acres in size.

The saline Hagga soils have a light brownish gray loam or clay loam surface layer about 5 inches thick. A thin, white, salt crust forms on the surface when the soil is dry. The subsoil to a depth of 48 inches is stratified sandy loam and clay loam. It is strongly alkaline and has common white salt flecks and yellowish brown mottles. These Hagga soils are poorly drained and have a very slowly permeable clay layer below 48 inches.

The included Ideon soils differ from the Hagga soils primarily in having more clay throughout the profile. The Ideon soils do not have the white salt crust on the surface but are strongly alkaline in the lower subsoils.

(Hc) Hill and Tinsley soils, 6 to 20 percent slopes--
Soils in this unit occur on moderately steep and rolling topography north and west of Big Sandy. Hill loam and Tinsley cobbly loam comprise about 70 percent of the unit. These soils occur in unpredictable patterns on convex slopes of ridges and mounds. The Hill soils comprise 40 to 50 percent of the unit and Tinsley cobbly and gravelly soils 15 to 30 percent. Devon loam is a major included soil. It occurs in narrow, irregular pattern on concave slopes adjacent to drainageways and comprises about 15 to 25 percent of the unit.

The Hill soils have a thin, light brownish gray, friable, calcareous, loam surface layer about 5 inches thick. The subsoils are calcareous, stratified loam and clay loam material with occasional gravel pockets and thin lenses of fine sandy loam. This kind of soil continues to depths of 6 feet or more.

The Tinsley soils have a thin, grayish brown, cobbly and gravelly loam surface layer about 4 inches thick. The subsoil to a depth of 5 feet or more is stratified very gravelly sandy loam, very gravelly loamy sand, and very fine sand. This soil is rapidly permeable and has very low available water storage because of its sandy texture.

The associated Devon soils have a grayish brown, friable, loam surface layer about 6 inches thick. The subsoil to about 12 inches is a friable clay loam with prismatic and blocky structure. Below 12 inches is a friable clay loam with prismatic and blocky structure. Below 12 inches the friable clay loam or loam soils become strongly calcareous, with weak prismatic structure in the upper part. The permeability of the Devon soils is moderately slow. These soils have good water storage capacity.

(Hd) Hill-Devon loams, 3 to 10 percent slopes--
The soils in this unit are found northeast of Big Sandy on moderately sloping and rolling topography. This unit consists mainly of Hill and Devon loams. The Hill soils comprise 45 to 60 percent of the unit and occur on the convex positions of the landscape. Devon soils make up 15 to 35 percent of the unit and occupy smooth slopes and some concave positions. These two soils occur in such irregular complex patterns that it is not feasible to make separation on a soil map at the scale used. Minor inclusions of Ethridge clay loam may occur in concave positions but make up less than 15 percent of the unit.

The Hill soils have a thin, light brownish gray, friable loam surface layer about 5 inches thick. The subsoil to 60 inches or more is stratified calcareous loam and clay loam.

The Devon soils in this unit have a grayish brown, friable, loam surface layer about 6 inches thick. The subsoil to 12 inches is friable clay loam with prismatic and blocky structure. Below 12 inches the soil is a clay loam or loam with weak prismatic structure which becomes massive below 24 inches. This soil is strongly calcareous and has some lime segregation. It is underlain by a compact clay loam glacial till or lacustrine deposit at 30- to 60-inch depths. Within a short distance these depths may vary as much as 2 feet. The permeability of the soil is moderately slow to the compact layer and is slow in the compact layer.

The Ethridge soils have a grayish brown, friable, clay loam or loam surface layer about 6 inches thick. The subsoil to about 18 inches is friable silty clay with prismatic and blocky structure. Below 18 inches the soil is a strongly calcareous silty clay loam with blocky structure in the upper part.

(Ia) Ideon clay loam, 0 to 1 percent slopes--
This soil occurs on the nearly level flood plain of Big Sandy Creek, which is subject to frequent overflow during periods of runoff. The Ideon soils comprise about 85 percent of the unit. Inclusions of Hagga soils occur in the narrow, slightly convex positions in areas less than 3 acres in size.

The poorly drained Ideon soils have a grayish brown, friable, clay loam surface layer about 5 inches thick. The subsoil below 5 inches is stratified calcareous clay loam and clay which is strongly alkaline and very hard when dry. It is slowly permeable and has yellowish brown mottles.

The poorly drained Hagga soils have a light brownish gray loam surface layer about 5 inches thick. The subsoil to a depth of 48 inches is stratified loamy materials that are moderately alkaline and have common yellowish brown mottles. Below 48 inches the soil is dominantly clay which is strongly alkaline and very slowly permeable.

(Ib) Ideon clay, alkali variant, 0 to 1 percent slopes--
This soil occurs on nearly level and slightly concave positions on the flood plain of Big Sandy Creek. The very strongly alkaline Ideon soils comprise about 70 percent of the unit. Inclusions of the normal Ideon clay loam soil occur on the slightly convex areas as long, narrow fingers. These areas are less than 2 acres in size.

The very strongly alkaline Ideon soils are light brownish gray clay to depths of 60 inches or more. Thin layers of loamy textured soils occur locally. This soil is very slowly permeable, poorly drained, and subject to overflow during periods of high runoff.

The normal Ideon clay loam soils have a grayish brown, friable, clay loam surface layer about 5 inches thick. The subsoil below 5 inches is stratified clay and clay loam which is calcareous, strongly alkaline, and slowly permeable.

(Ic) Ideon clay, sandy substratum phase, 0 to 1 percent slopes--
This soil occurs on nearly level to very gently undulating topography on the flood plain of Big Sandy Creek. It is subject to overflow during periods of runoff. The sandy substratum phase of Ideon soils comprises about 80 percent of the unit. Minor inclusions of Hagga clay loam, saline phase, occur on slightly convex positions in long, narrow fingers less than 2 acres in size.

In this unit the poorly drained Ideon soils have a light brownish gray, strongly alkaline, clay or clay loam surface layer about 9 inches thick. The subsoil to a depth of 26 inches is stratified, calcareous clay and clay loam with yellowish brown mottles. The soil is slowly permeable to 26 inches. Below 26 inches the soils are sandy loam and loamy sand and are strongly alkaline and moderately permeable. The water table fluctuates rapidly with changes in streamflow of Big Sandy Creek.

The poorly drained Hagga clay loam, saline phase, has a light brownish gray surface layer about 5 inches thick. A thin, white, salt crust forms on the surface when dry. The subsoil to 40 inches or more is stratified loam and friable clay loam with yellowish brown mottles and common white salt flecks.

(Pa) Poser-Kerwin clay loams, 0 to 1 percent slopes--
The soils in this complex occur south of Big Sandy on nearly level terraces. This unit comprises Poser and Kerwin clay loam soils. The Poser soils occupy the concave positions and comprise 50 to 70 percent of the unit. The Kerwin soils are commonly found on the nearly level to slightly concave positions.

The Poser soils have a light brownish gray clay loam surface layer about 6 inches thick which forms a crust when dry. The subsoil to about 27 inches is firm clay with prismatic and blocky structure. Dark yellowish brown mottles are present in this layer. Below 27 inches the soil is a strongly calcareous clay with many visible soft lime nodules. The slowly permeable Poser soils receive additional runoff from adjacent areas and temporary ponding is common to many areas.

The Kerwin soils have a grayish brown, friable, silty clay loam surface layer about 10 inches thick. The subsoil to about 24 or 29 inches is friable silty clay with blocky and prismatic structure. Below 29 inches the soil is a massive, calcareous silty clay loam and silty clay which is strongly alkaline and slowly permeable.

(Pb) Poser, moderately well drained variant-Emmer loams, 0 to 1 percent slopes--
Soils in this complex occur on very gently undulating terraces south of Big Sandy. Poser loam, moderately well drained variant, and Emmer loam comprise about 80 percent of the mapping unit. The Poser soils make up about 50 percent of the unit and occur in the slightly concave positions. The Emmer soils comprise about 30 percent of the unit and occupy the nearly level to slightly convex positions. Minor inclusions of strongly alkaline soils occur on the slightly higher convex portion of the landscape. These strongly alkaline soils comprise about 20 percent of the mapping unit. They occur in small areas in a very complex pattern.

The Poser, moderately well drained variant, soil has a light brownish gray loam surface layer about 7 inches thick which forms a hard crust on drying. The subsoil to 15 inches is a firm clay with blocky and prismatic structure. It lacks the distinct, yellowish brown mottles of the typical Poser soil. Below 15 inches the soil is strongly calcareous clay and clay loam which is strongly alkaline and contains white flecks of segregated lime and gypsum. This soil is slowly permeable.

The Emmer soils have a grayish brown, friable, loam surface layer about 6 inches thick. The subsoil to 16 inches is a clay texture with

prismatic and blocky structure. Below 16 inches the clay soil is massive, strongly calcareous and strongly alkaline. Soil permeability is slow to very slow.

(Ra) Rista clay loam, 0 to 1 percent slopes--
This soil occurs on the nearly level flood plain adjacent to Big Sandy Creek where the soil is frequently flooded. The Rista soils make up about 80 percent of the unit. Inclusions of poorly drained Hagga soils occur in concave positions and comprise less 20 percent of the unit.

The Rista soils, which are calcareous, have a grayish brown, friable, clay loam or loam surface layer about 5 inches thick. The subsoil to a depth of about 60 inches is stratified and predominantly sandy loam, loam, clay loam, and loamy fine sand texture. Yellowish brown mottles occur throughout the soil. Below 60 inches the soil has slowly permeable clay layers.

The poorly drained Hagga soils have a light brownish gray, friable loam surface layer about 5 inches thick. The subsoil to a depth of about 48 inches has stratified loamy textures. This soil is calcareous, strongly alkaline, and has common yellowish brown mottles. Below 48 inches, the soil is dominantly clay which is slowly permeable.

(Rb) Rista clay loam, wet phase, 0 to 1 percent slopes--
This very poorly drained soil occurs on nearly level and slightly concave positions on the flood plain of Big Sandy Creek. These wet soils comprise about 75 percent of the unit. Inclusions of Ideon soils occupy slightly higher portions of the landscape. They occur as narrow fingers in areas less than 3 acres in size.

The Rista soils have a grayish brown, friable, clay loam surface layer about 5 inches thick. The subsoil is stratified, calcareous, sandy loam and loam textures that are usually wet and have yellowish brown mottles. Below 50 inches there are slowly permeable clay layers that are very hard when dry and strongly alkaline.

The Ideon soils have a light brownish gray clay loam or clay surface layer about 9 inches thick, which is strongly alkaline. The subsoil to a depth of 25 inches is stratified clay and silty clay that is calcareous and has yellowish brown mottles. Below 26 inches the soil is more sandy than is typical for the Ideon soils.

SECTION II. SOIL INTERPRETATIONS FOR LAND USE PLANNING

This section contains the kinds of soil interpretations that should guide land use decisions of engineers, contractors, planners, home owners, and farmers. Soil interpretations are predictions of how soils will react or behave under specific use and treatment. These interpretations are based on soil properties to a depth of five feet and provide the layman with the kinds of soil information that can be readily understood and used when making land use decisions. They point out the limitations and hazards of each kind of soil for a particular kind of use. They are not recommendations and should not be used when determining the need for specific design and construction. They will not eliminate the need for on-site sampling and testing for the design and construction of engineering works.

Colored maps are used to show the limitations and hazards of soils for different kinds of uses. Color ratings of green, yellow and red are used, based on the most limiting soil quality of a soil. Green is used for the soils having the least limitation, yellow for the next, and red for the soils with the greatest limitation. There are three colored interpretive maps contained in this report. Each map shows the evaluation of soils for a particular kind of use. These are single-purpose interpretive maps--a very effective way to show what soil areas are best suited for a particular kind of use.

In some areas soils occur in complex patterns, and mapping units must, by necessity, include more than one kind of soil. In areas where two or more soils behave differently, it becomes necessary to make the evaluation on the most limiting soil in the complex, provided it comprises one-third of the area in the mapping unit.

Guides and criteria used in making specific interpretations are included in Section III of this report.

Soil Characteristics and Qualities

Table 2 shows the important soil characteristics and qualities of each kind of soil that influence its use. Definitions of column headings for Table 2 are given below.

(1) Soil Series names. All soil series names are tentative and subject to change.

(2) Position is the kind of land form or type of topography on which the soil occurs.

Soil Profile is a vertical section of the soil through all of its horizons or layers extending from the surface into the parent material. This is subdivided into three major horizons: surface layer, subsoil, and substratum.

(3) Surface Layer is the uppermost layer of soil. It varies in thickness for each kind of soil. Usually it is no more than 8 inches thick.

(4) Subsoil is that part of the soil profile lying between the surface layer and the substratum. It varies in thickness in relation to the contrast of soil characteristics below.

(5) Substratum is the lower portion of the soil profile that has been least altered by soil forming processes.

Soil Drainage refers to the rapidity and extent of the removal of water from the soil in relation to surface runoff and by flow through the soil to underground spaces. Two types of soil drainage are significant to evaluation for multiple land use treatment: surface and internal.

(6) Surface Runoff refers to the rate water is removed from the soil by surface flow. It may fall in the form of rain or accumulate as runoff from adjacent areas.

(7) Drainage Class is determined on the basis of observation and inferences used to obtain rate of runoff, soil permeability and internal movement of water through the soil. Six drainage classes were used and they are defined in the Glossary.

(8) Flooding or Overflow refers to the frequency that excessive water accumulates or flows over the soil surface from stream flooding, runoff, or seepage for more than two consecutive days. The frequency of flooding for residential use is more critical than for cropland use. The flood class hazard rating is based on residential use of the land, not for agriculture.

Classes		Frequency
Never	-	
Occasional	-	Once in 15 years
Frequent	-	More often than once in 15 years

(9) AWC (Available Water Capacity) is the amount of water held in the soil that is available for plant growth after all free water has drained away. It is expressed as inches of water per 5-foot depth of soil.

(10) Effective Soil Depth is the depth to which the soil is readily penetrated by roots and utilized for extraction of water and plant nutrients. The soils in this area were all more than 60 inches deep.

(11) Erosion Hazard is the relative susceptibility of the soil to the prevailing erosion agents of water and wind. In general, the risk of erosion depends on soil texture, structure, slope, vegetative cover, runoff, and stream overflow. Erosion hazards are listed as slight, moderate, or severe, based on the soil qualities which make them susceptable to erosion if they are not protected by an adequate plant cover.

Table 2. Soil Characteristics and Qualities

Soil Series (1)	Position (2)	Soil Profile			Soil Drainage		Flooding or Overflow (8)	AWC Inches Per 5 Feet (9)	Effective Soil Depth (10)	Erosion Hazard (11)
		Surface Layer (3)	Subsoil (4)	Substratum (5)	Surface Runoff (6)	Drainage Class (7)				
Absher soils	Slightly concave--small basins	2-5" grayish brown loam; soft crumb structure	5-20" grayish brown silty clay loam; distinct blocky structure that is very hard and moderately alkaline	20-100" light brownish gray clay; weak medium and coarse blocks; very hard; strongly alkaline	Slow	Moderately well drained	Occasional[1]	10-11"	60"+	Slight
Devon soils	Nearly level to moderately sloping fan terraces	5-6" grayish brown loam; soft crumb structure	6-40" brown clay loam; prismatic and blocky structure; hard when dry	40-60" light brownish gray compact clay loam; massive; very hard; calcareous; strongly alkaline	Medium to rapid	Well drained	Never	8-10"	60"+	Slight
Devon, thick solum phase	Nearly level to slightly concave terraces	8-10" grayish brown loam; soft crumb structure	10-26" brown clay loam; prismatic and blocky structure; hard; mildly alkaline	26-60" light brownish gray clay loam and loam; massive; very hard; calcareous; strongly alkaline	Medium	Well drained	Never	8-10"	60"+	Slight
Devon, alkali variant	Nearly level to gently sloping fan terraces	4-6" grayish brown loam; slightly hard; crumb structure.	6-11" brown clay loam; prismatic and blocky structure; hard; moderately alkaline	11-60" light brownish clay loam; massive; very hard; calcareous; very strongly alkaline	Medium	Well drained	Never	7-9"	60"+	Slight
Emmer soils	Nearly level to very gently undulating terraces; slightly convex positions	5-6" grayish brown loam; weak platy and crumb structure; slightly hard	6-21" grayish brown clay; strong blocky and prismatic structure; very hard; mildly alkaline	21-60" gray clay; massive; very hard; calcareous; strongly alkaline	Slow	Well drained	Frequent	9-11"	60"+	Slight
Ethridge soils	Nearly level terraces and slightly concave slopes	7-10" grayish brown clay loam; granular structure; slightly hard	10-16" brown clay loam; prismatic and blocky structure; very hard	16-60" light brownish gray clay loam; massive; very hard; calcareous; strongly alkaline	Medium	Moderately well drained	Frequent	9-11"	60"+	Slight
Lega soils	Nearly level flood plain	4-5" grayish brown loam; crumb structure; slightly hard	5-48" gray stratified clay loam and sandy loam textures; calcareous and mottled	48-60" gray clay; massive; very hard; strongly alkaline	Slow	Poorly	Frequent	8-10"	60"+	Severe
Lagga, saline phase	Nearly level flood plain	4-5" light brownish gray loam or clay loam; strongly alkaline and saline	5-48" gray stratified clay loam and sandy loam textures; mottled; strongly alkaline	48-60" gray clay; massive; very hard; strongly alkaline and wet	Slow	Poorly drained	Frequent	8-10"	60"+	Severe

[1] Short Term

Table 2 (Continued)

Soil Series (1)	Position (2)	Soil Profile			Soil Drainage		Flooding or Overflow (8)	AWC Inches Per 5 Feet (9)	Effective Soil Depth (10)	Erosion Hazard (11)
		Surface Layer (3)	Subsoil (4)	Substratum (5)	Surface Runoff (6)	Drainage Class (7)				
Hill soils	Moderately steep and rolling convex slopes	4-6" light brownish gray loam; slightly hard; crumb structure; calcareous	6-60" light yellowish brown stratified clay loam & loam; massive; hard; calcareous		Rapid	Well drained	Never	8-10"	60"+	Moderate
Ideon soils	Nearly level flood plain	5-6" grayish brown clay loam; crumb structure; slightly hard; calcareous	6-60" gray stratified clay loam & clay; massive; very hard; calcareous; strongly alkaline; mottled		Slow	Poorly drained	Frequent	10-11"	60"+	Severe
Ideon, alkali variant	Nearly level flood plain	5-6" gray clay; granular structure; very hard; strongly alkaline; calcareous	6-60" gray clay, common yellowish brown mottles; massive;very hard; very strongly alkaline; calcareous		Slow	Somewhat poorly drained	Frequent	10-11"	60"+	Severe
Ideon, sandy substratum phase	Nearly level flood plain	7-9" light brownish gray clay or clay loam; granular and blocky structure; very hard; strongly alkaline	9-26" gray stratified clay loam and clay textures; mottled; calcareous	26-60" gray stratified sandy textures; wet; strongly alkaline	Slow	Poorly drained	Frequent	7-9"	60"+	Severe
Kerwin soils	Nearly level to slightly concave terraces	8-10" grayish brown silty clay loam; cloddy and crumb structure; hard	10-29" dark brown silty clay; strong blocky & prismatic; very hard; moderately alkaline	29-60" light brownish gray silty clay loam and silty clay; strongly alkaline	Slow	Moderately well drained	Frequent	10-11"	60"+	Slight
Nobe soils	Nearly level terrace in concave position	1-2" light brownish gray loam; hard massive crust; moderately alkaline	2-10" brown clay; blocky & prismatic; very hard; salts present	10-60" grayish brown clay; massive; very hard; strongly alkaline	Very slow	Moderately well drained	Occasional	3-4"	60"+	Severe
Poser soils	Nearly level	5-6" light brownish gray clay loam; platy structure; very hard; crusts easily	6-27" gray clay; strong blocky & prismatic; very hard; moderately alkaline; mottled	27-60" grayish brown clay; massive; very hard; calcareous; moderately alkaline	Slow	Moderately well drained	Frequent	10-11"	60"+	Slight
Poser, moderately well drained variant	Nearly level terrace in slightly concave position	5-8" light brownish gray loam; hard massive crust	8-15" brown clay; strong blocky and prismatic; very hard; moderately alkaline	15-60" light brownish gray clay and clay loam; massive; very hard; strongly alkaline	Slow	Well drained	Occasional	9-10"	60"+	Slight
Rista soils	Nearly level flood plain	5-6" gray clay loam and loam; granular and stratified; hard; calcareous	6-60" gray stratified sandy loam, loam and clay loam; massive; hard; strongly alkaline; calcareous; yellowish brown mottles		Medium	Poorly drained	Frequent	7-9"	60"+	Severe

Table 2 (continued)

Soil Series (1)	Position (2)	Soil Profile			Soil Drainage		Flooding or Overflow (8)	AWC Inches Per 5 Feet (9)	Effective Soil Depth (10)	Erosion Hazard (11)
		Surface Layer (3)	Subsoil (4)	Substratum (5)	Surface Runoff (6)	Drainage Class (7)				
Rista, wet phase	Nearly level to slightly concave flood plain	5-6" gray clay loam; platy structure; hard	6-50" gray stratified loam & sandy loam; massive; hard; strongly alkaline; calcareous; yellowish brown mottles	50-60"+ gray clay massive; very hard; strongly alkaline: calcareous; mottled	Slow	Poorly drained	Frequent	8-10"	60"+	Severe
Tinsley soils	Moderately steep rolling knolls & ridges	4-5" grayish brown gravelly loam; granular; soft	5-60+" light brownish gray very gravelly loamy sand with layers of loamy fine sand; single grained; calcareous		Medium	Excessively drained	Never	5-6"	60"+	Moderate

Estimated Physical and Chemical Properties of Soils

Table 3 contains information about each kind of soil, based on field observations, detailed soil descriptions, and special engineering test data. From this information, soil scientists, engineers, and land use planners can make predictions about soil behavior for specific uses. Explanations of column headings are given below:

(1) Soil Series. Each kind of soil is listed separately by series. Where mapping units have more than one kind of soil, ratings are given for individual components at the series level.

(2) Depth to Seasonal High Water Table. This is the depth in inches from the ground surface to the highest seasonal water table. This depth is determined largely by soil colors and mottles and by observations in holes and pits. The duration of the water table at a certain level varies with seasons, and the range of seasonal fluctuation is given in this column where it is known.

(3) Soil Depth From Surface. This column indicates the depth at which the major soil layers occur from the surface. The layers described are fairly typical of the major horizons for all the soils of any one series. The soil properties described in the remaining columns are listed for each of these layers.

Soil Texture Classification refers to the particle size distribution of sand, silt and clay. The physical properties associated with their behavior under different moisture tensions are considered in these evaluations. There are three systems of classifications given:

(4) United States Department of Agriculture (USDA) system gives the soil texture values in terms of clay, silty clay, sandy clay, clay loam, sandy clay loam, silty clay loam, loam, silt loam, silt, sandy loam, loamy sand, and sand.

(5) Unified classification system, used by engineers, is based on the plastic qualities of soil associated with texture in respect to their performance under physical disturbance. The gravel fraction of the soil mass is included in the evaluation.

(6) AASHO classification system was developed by the American Association of State Highway Officials for evaluating soils properties affecting road construction and load-carrying capacity. The rating of A-1 is for the best soils, and A-7 is for the poorest.

(7) Range in Permeability relates to the downward movement of water through saturated, undisturbed soil. It is expressed in terms of inches per hour.

(8) Range in Available Moisture Capacity is the amount of water held in the soil for plant growth after all free water has drained away. It is expressed in inches of water held per inch depth of soil.

(9) Soil Reaction (pH) shows the range in reaction (alkaline or acid) for each layer, expressed in pH (see Glossary for more information on reaction values).

(10) Shrink-Swell Potential is the potential volume change of a wet soil compared to the same soil when dry. The volume change behavior of soils is influenced by the amount and kind of clay present in the soil. In general, soils classified as CH or A-7 have a high shrink-swell potential, whereas soils having high sand and gravel content with small amounts of clay and silt have a low shrink-swell potential. Values of low, moderate and high are used to rate each major soil layer.

(11) Frost Heave Potential refers to the heaving of soils upon freezing as a result of the formation of ice crystals or lenses in the soil. This is extremely noticable in the spring when the freezing and thawing action is most intense. The intensity of the problem is associated with soil and drainage characteristics. Values of high, moderate and low are used to rate this soil hazard for soils when frost heave is a problem.

High hazard - soils having water tables within 36 inches of the surface and soils with coarse pores, often found in silty textures.

Moderate hazard - soils that are moderately well drained and have a high proportion of sand in relation to silt plus clay.

Low hazard - soils that are well drained and have a low proportion of silt plus clay in relation to sand and gravel.

Soil Corrosivity is the chemical action of the soil that corrodes structural material such as concrete or metal when buried in the soil. The potential corrosion ratings of low, moderate and high are given for each major soil layer. Guides for evaluating the corrosivity of soil on untreated steel and an interpretive map showing the more hazardous areas of corrosion are found on pages 65 and 66 of Section III of this report.

(12) Concrete placed in soil may be affected by the presence of certain kinds of chemicals found in certain soils. These chemicals are in the form of acid salt crystals, primarily sodium and magnesium sulfates. These salt crystals are quite soluble and go into solution easily. The salt solution enters the pores of concrete and when drying reforms crystals which expand and rupture the concrete causing deterioration. The rate of deterioration is dependent on the kind and amount of salt present and the porosity of the concrete. When salts are a problem, the corrosivity on concrete can be reduced by using sulfate resistant cement and quality concrete with a minimum of pores.

(13) Untreated Steel. The rusting or corrosion of untreated metal when in contact with soil is a physical-biochemical process of oxidation which converts iron into ions. The presence of air and water are both needed for this process. The soil corrosivity is commonly

determined by electrical resistivity of the soil to the flow of current. The total acidity, soil drainage, and soil texture all have an effect on the oxidation-reduction process.

Table 3. Estimated Physical and Chemical Properties of Soils

Soil Series (1)	Depth to Seasonal High Water Table (2)	Soil Depth from Surface (3)	Soil Texture Classification			Range in Permeability Inches Per Hour (7)	Range in Available Moisture In/In of Depth (8)	Soil Reaction pH (9)	Shrink-Swell Potential (10)	Frost Heave Potential (11)	Soil Corrosivity	
			USDA (4)	Unified (5)	AASHO (6)						Concrete (12)	Untreated Steel (13)
Absher soils	Below 72"	0-4"	loam	ML	---	.2-.63	.15-.17	7.4-7.8	low	moderate	moderate	---
		4-20"	silty clay	CL	A-6	.06-.2	.18-.20	7.4-8.6	high	high	high	high
		20-60"	silty clay	CL	A-7	< .06	.17-.18	8.5-9.2	high	high	high	high
Devon soils	Below 72"	0-6"	loam	ML	-	.63-2.0	.15-.17	7.4-8.0	low	moderate	low	---
		6-40"	clay loam & loam	CL	A-6	.63-2.0	.16-.19	7.9-8.4	moderate	high	low	low
		40-60"	clay loam	CL	A-6	.06-0.2	.15-.17	8.5-9.0	moderate	high	moderate	moderate
Devon, thick solum phase	Below 72"	0-8"	loam	ML	---	.63-2.0	.15-.17	7.4-7.8	low	moderate	low	---
		8-26"	clay loam	CL	A-6	.63-2.0	.16-.19	7.4-7.8	moderate	high	low	low
		26-60"	clay loam to loam	CL	A-6	.2-.63	.15-.17	8.5-9.0	moderate	high	moderate	moderate
Devon, alkali variant	Below 72"	0-6"	loam	ML	---	.63-2.0	.15-.17	7.4-8.0	low	moderate	moderate	---
		6-11"	clay loam	CL	A-6	.2-.63	.16-.19	7.9-8.4	moderate	high	high	high
		11-60"	loam & clay loam	CL	A-6	.06-.2	.14-.16	8.6-9.2	moderate	high	high	high
Emmer soils	Below 72"	0-6"	loam	ML	---	.63-2.0	.15-.17	7.4-7.8	low	moderate	moderate	---
		6-21"	clay	CH	A-7	.06-.2	.18-.22	7.4-7.8	high	high	high	high
		21-60"	clay	CH	A-7	< .06	.16-.19	8.6-9.0	high	high	high	high
Ethridge soils	Below 72"	0-10"	clay loam	CL	-	.63-2.0	.16-.19	7.4-7.8	moderate	high	low	---
		10-16"	heavy clay loam	CL	A-6	.2-.63	.18-.20	7.4-7.8	moderate	high	low	low
		16-60"	clay loam	CL	A-6	.2-.63	.16-.19	8.5-8.8	moderate	high	moderate	moderate
Hagga soils	20-40"	0-5"	loam	ML	---	.63-2.0	.15-.17	7.9-8.4	low	high	high	---
		5-48"	clay loam and sandy loam	ML-CL	A-4	.2-.63	.15-.17	8.4-9.0	low	high	high	high
		48-60"	clay	CH	A-7	< .06	.16-.19	8.6-9.0	high	high	high	high
Hagga, saline phase	20-40"	0-5"	loam or clay loam	CL	---	.2-.63	.14-.16	8.5-9.0	low	high	high	---
		5-48"	clay loam and sandy loam	ML-CL	A-4	.2-.63	.14-.16	8.5-9.0	low	high	high	high
		48-60"	clay	CH	A-7	< .06	.16-.19	8.5-9.0	high	high	high	high
Hill soils	Below 72"	0-6"	loam	ML	---	.63-2.0	.15-.17	8.3-8.6	low	moderate	low	---
		6-60"	loam and clay loam	CL	A-4	.2-.63	.15-.17	8.5-8.8	low	moderate	moderate	moderate
Ideon soils	20-40"	0-6"	clay loam	CL	---	.2-.63	.16-.19	7.9-8.4	moderate	high	moderate	---
		6-60"	clay loam & clay	CL	A-7	.06-0.2	.18-.20	8.5-9.0	high	high	high	high
Ideon, alkali variant	20-48"	0-6"	clay	CH	---	.06-.2	.18-.20	8.2-8.6	high	high	high	---
		6-60"	clay	CH	A-7	< .06	.18-.20	9.0-9.4	high	high	high	high
Ideon, sandy substratum phase	20-40"	0-9"	clay to clay loam	CL	---	.06-.2	.18-.20	8.5-9.0	high	high	high	---
		9-26"	clay loam & clay	CL	A-6	.06-.2	.16-.19	8.6-9.0	moderate	high	high	high
		26-60"	sandy loam & loamy sand	SM	A-2	.63-2.0	.12-.14	8.6-9.0	low	high	high	high

Table 3 (Continued)

Soil Series (1)	Depth to Seasonal High Water Table (2)	Soil Depth from Surface (3)	Soil Texture Classification			Range in Permeability Inches Per Hour (7)	Range in Available Moisture In./In. of Depth (8)	Soil Reaction pH (9)	Shrink-Swell Potential (10)	Frost Heave Potential (11)	Soil Corrosivity	
			USDA (4)	Unified (5)	AASHO (6)						Concrete (12)	Untreated Steel (13)
Kerwin soils	Below 72"	0-10"	Silty clay loam	CL	---	.2-.63	.16-.19	7.4-7.8	low	high	low	---
		10-29"	Silty clay	CL	A-7	.06-.2	.18-.22	7.9-8.4	high	high	moderate	moderate
		29-60"	Silty clay loam to silty clay	CL	A-7	.06-.2	.16-.19	8.5-9.0	moderate	high	high	high
Nobe soils	Below 40"	0-2"	loam	ML	---	---	.05-.1	7.9-8.4	low	moderate	high	---
		2-10"	clay	CL	A-7	< .06	.05-.1	8.5-9.0	high	high	high	high
		10-60"	clay	CL	A-7	< .06	.05-.06	8.5-9.0	high	high	high	high
Poser soils	Below 72"	0-6"	clay loam	CL	---	.2-.63	.16-.19	6.6-7.3	low	high	low	---
		6-27"	clay	CH	A-7	.06-.2	.18-.22	7.4-8.4	high	moderate	moderate	high
		27-60"	clay	CH	A-7	.06-.2	.18-.22	7.9-8.4	high	moderate	moderate	high
Poser, moderately well drained variant	Below 72"	0-8	loam	ML	---	.63-2.0	.15-.17	6.6-7.3	low	moderate	moderate	---
		8-15"	clay	CH	A-7	.06-.2	.18-.22	7.2-7.8	high	moderate	moderate	high
		15-60"	clay & clay loam	CH	A-7	.06-.2	.16-.19	8.6-9.0	high	moderate	high	high
Rista soils	20-40"	0-6"	clay loam & loam	CL	---	.63-2.0	.16-.19	8.4-9.0	moderate	high	high	---
		6-60"	loam, sandy loam, and clay loam	ML	A-4	.63-2.0	.12-.15	8.5-9.0	low	high	high	high
Rista, wet phase	0-30"	0-6"	clay loam	CL	---	.63-2.0	.16-.19	7.9-8.4	moderate	high	high	---
		6-50"	loam & sandy loam	ML	A-4	.63-2.0	.12-.15	8.6-9.0	low	high	high	high
		50-60"	clay	CH	A-7	.06-.2	.18-.20	8.6-9.0	high	high	high	high
Tinsley soils	Below 72"	0-5"	gravelly loam	GM	---	.63-2.0	.13-.16	7.4-7.8	low	low	low	---
		5-60"	very gravelly loamy sand	GM	A-2	6.3-20	.08-.10	7.9-8.4	low	low	low	low

Interpretations of Engineering Properties of Soils

Table 4 shows the interpretations of engineering properties of soils and gives estimates of the suitability of each soil for specific uses and the major soil limitations for these uses. The estimates in this table are based on laboratory test data and the judgment of soil scientists and engineers who have worked in the area. Explanations of column headings are given below.

(1) Soil Series names are tentative and subject to change.

Suitability of soils as a source of:

(2) Topsoil. Usually the top 6 to 10 inches of soil is richest in plant nutrients and organic matter and is best to topdress lawns, gardens, parks and roadbanks. Good, fair, and poor suitability ratings are given to rate each soil for this kind of use.

(3) Sand and Gravel as a source of aggregate for concrete or other structural aggregate needs. Ratings of good, fair, poor or unsuitable are used to rate each soil for this kind of use.

(4) Roadfill refers to the suitability of material to be used for embankment to support normal modern day traffic. Ratings of good, fair, or poor are used to evaluate each soil for this kind of use.

(5) Highway Location. Soil factors considered for highway location are those physical features that affect performance. The entire soil profile is evaluated, based on an undisturbed soil. It is assumed the surface soil layer high in organic matter will be removed in construction. Factors affecting the soil for this use are identified in the table.

(6) Dikes and Levees. Soil features considered are those that influence the suitability of the disturbed soil materials for constructing relatively low height and low hazard structures. Factors affecting the soil for this use are identified in the tables.

(7) Winter grading. The suitability of soils for winter grading depends on the ease with which the soil can be moved and traversed by ordinary construction equipment during cold weather. Soil features affecting winter grading are given in the table.

Table 4. Interpretations of Engineering Properties of Soils

Soil Series Names (1)	Suitability as a Source of-- Topsoil (2)	Sand and Gravel (3)	Roadfill (4)	Soil Features Affecting-- Highway Location (5)	Dikes & Levees (6)	Winter Grading (7)
Absher soils	Poor--thin surface and high clay	Unsuitable	Poor--highly plastic and poor stability	Highly plastic clays: frost heave hazard	Unstable on slopes: high shrink-swell	Low stability on freezing and thawing: high plasticity
Devon soils	Good to 8"	Unsuitable	Fair to poor: clays with low to moderate plasticity, A-6	High frost heave hazard	Moderate shrink-swell	Low stability on freezing and thawing
Devon, alkali variant	Fair to 6": some salts	Unsuitable	Fair to poor: clays with low to moderate plasticity, A-6	High frost heave hazard	Moderate shrink-swell; low stability	Low stability on freezing and thawing
Emmer soils	Good to 6"	Unsuitable	Poor--highly plastic clays	High plasticity; poor compaction	High shrink-swell: low stability	High plasticity; low stability on freezing and thawing
Ethridge soils	Good to 10"	Unsuitable	Fair to poor: clays with low to moderate plasticity	High frost heave hazard	Moderate shrink-swell	Low stability on freezing and thawing
Hagga soils	Good to 5"	Unsuitable	Fair--high frost heave action: poor drainage	Poor drainage, flooding, and high frost heave action	None	Poor drainage; high frost heave; large frozen clods
Hagga, saline phase	Unsuitable	Unsuitable	Fair to poor: high frost heave: high salts: high water table	Poor drainage, flooding, and high frost heave action	High salts; low stability	Poor drainage; high frost heave, large frozen clods
Hill soils	Fair to 6"	Unsuitable	Fair to good: subject to frost heave	Frost heave topography	None	Low stability on freezing and thawing
Ideon soils	Fair to 5"	Unsuitable	Poor--highly plastic clays: high shrink-swell: high frost heave	Poor drainage; flooding; plastic clay: high frost heave	High shrink-swell; low stability	Poor drainage; high frost heave; plastic clays
Ideon, Alakli variant	Unsuitable					
Ideon, sandy substratum variant	Poor--high clay	Unsuitable	Fair--plastic clay to 26": poor drainage affects Accessibility	Poor drainage: flooding: high frost heave	Subject to piping: low stability	Poor drainage; high frost heave: flooding
Kerwin soils	Fair to 10": hard cloddy or crusty surface	Unsuitable	Poor--highly plastic clay: high shrink-swell	Plastic clay: high frost heave action	High shrink-swell: low stability	Low stability on freezing & thawing; high plasticity
Nobe soils	Unsuitable	Unsuitable	Poor--highly plastic clay: low stability: high salts	Plastic clays high frost heave action: high salts: low stability	Low stability: high salts: subject to piping	Plastic clays; low stability on freezing and thawing
Poser soils	Poor--hard crusty surface	Unsuitable	Poor--highly plastic clays: low stability	Plastic clay: high shrink-swell	High shrink-swell: low stability	plastic clays: low stability on freezing and thawing
Poser, moderately well drained variant	Fair--hard cloddy and crusty surface	Unsuitable	Poor--highly plastic clays: low stability	Plastic clay: high shrink-swell	High shrink-swell: low stability	Plastic clays: low stability on freezing and thawing

Table 4. (Continued)

Soil Series Names (1)	Suitability as a Source of-- Topsoil (2)	Sand and Gravel (3)	Roadfill (4)	Soil Features Affecting-- Highway Location (5)	Dikes & Levees (6)	Winter Grading (7)
Rista soils--	Fair to 6"; thin surface: clay texture below	Unsuitable	Fai. o 50": poor drainage: high frost heave action	Poor drainage; flooding; high frost heave	Subject to piping	Poor drainage; high frost heave; flooding
Tinsley soils	Poor--thin surface: gravel content	Good if washed	Good	Topography cuts and fills	Rapidly permeable; coarse texture	None

Soil Suitability for Agriculture

Soils and climate are the major factors affecting crop production. Table 5, Soil Suitability for Agriculture, lists the land capability classification relative to its suitability for cultivated crops and the limiting factors for each soil.

The land capability classification is a means of expressing the relative hazards and limitations of soils or climate when used for cultivated crops, range or woodland. There are eight capability classes which are designated by Roman numerals I through VIII. The risks of soil damage or limitations for use in agriculture become progressively greater from Class I through Class VIII. Soils in Class I have few limitations, have the widest range of use, and have the least risk of damage for all uses. Soils in classes I through IV, under good management, are suitable for growing cultivated crops common to the area. Soils in Classes V, VI and VII are not suitable for cultivation but can be safely used for pasture, range, woodland or wildlife. Soils in land capability Class VIII are not suitable for commercial production of cultivated crops, range or wood products. They are suitable only for wildlife and recreation use.

Land capability classes are divided into subclasses to show the major kind of limitation or hazard affecting their use. The four subclasses are: e - erosion hazard (wind or water); w - wetness or flooding; s - soil limitations such as stoniness, shallowness, high clay or alkali content; c - climatic limitation such as cold temperatures or lack of rainfall to meet crop needs.

The twenty-one different mapping units can be grouped into three land capability classes using all of the subclasses. The are defined below:

Land Capability IIIe. Soils subject to severe erosion if they are cultivated and not protected. They require special conservation practices or treatment to minimize the erosion hazard when cropped.

Land Capability IIIs. Soil quality affecting crop production is severely limited by strongly alkaline soils and clay textures which are slowly permeable.

Land Capability IIIc. Soil quality is good but crop production is limited because of relatively low annual rainfall.

Land Capability IVe. Soils subject to very severe erosion if they are cultivated and not protected. They require very carefull management and special conservation practices to keep erosion under control.

Land Capability VIe. Soils generally unsuited for cultivation because of severe hazard of erosion. Their agricultural use is limited largely to range, wildlife and recreation.

Land Capability VIw. Soils severely limited for use because of the high risk of flooding, seasonal high water table, and strong alkalinity. Perennial plant cover is needed for adequate protection.

Land Capability VIs. Soils severely limited for agricultural use because of very slowly permeable and strongly to very strongly alkaline subsoil.

Table 5 lists each soil mapping unit and shows its land capability classification, relative suitability for growing cultivated field crops, hay and garden vegetables, and its relative suitability for range use. The following ratings are used: very good, good, fair and poor. The ratings of mapping units having more than one kind of soil are based on the most limiting factors affecting use. The most limiting soil comprises at least 30 percent of the unit.

Table 5. Soil Suitability for Agriculture

Soil Mapping Unit Symbol (1)	Land Capability Classification (2)	Cultivated field Crops (3)	Suitability for: Hay (4)	Garden Vegetables (5)	Range (6)	Most Limiting Factors (7)
Aa	IVe	Fair	Fair	Poor	Fair	Alkalinity: slow permeability
Ab	VIs	Poor	Poor	Poor	Fair	Alkalinity; slow permeability
Da	IIIc	Very good	Very good	Very good	Very good	Low annual rainfall
Db	IIIc	Very good	Very good	Very good	Very good	Low annual rainfall
Dc	IIIe	Good	Very good	Good	Very good	Low rainfall; topography
Dd	IIIc	Very good	Very good	Good	Very good	Low rainfall
De	IIIs	Fair	Fair	Fair	Good	Alkalinity
Df	IIIs	Fair	Fair	Fair	Good	Alkalinity
Ea	IIIs	Good	Good	Fair	Good	Alkalinity; slow permeability
Eb	IIIc	Very good	Very good	Very good	Very good	Low rainfall
Ha	VIw	Poor	Good	Poor	Very good	Flooding; high water table
Hb	VIw	Poor	Fair	Poor	Good	Flooding; salinity
Hc	VIe	Poor	Poor	Poor	Good	Steep slopes; gravelly soil
Hd	IIIe	Good	Very good	Good	Very good	Moderate slopes; low rainfall
Ia	VIw	Poor	Good	Poor	Very good	Flooding; high water table
Ib	VIw	Poor	Fair	Poor	Good	Flooding; alkalinity
Ic	VIw	Poor	Good	Poor	Very good	Flooding; high water table
Pa	IVw	Poor	Good	Fair	Good	Flooding; slow permeability
Pb	IIIs	Good	Good	Fair	Good	Slow permeability
Ra	VIw	Poor	Good	Poor	Very good	Flooding; high water table
Rb	VIw	Poor	Fair	Poor	Good	Flooding; high water table

Trees and Shrubs for Protection and Beautification

No conservation measure applied to the land provides so many year-round benefits as does the planting and care of trees and shrubs. Protection from winter winds, catchment of blowing snow, shade from the hot summer sun, and beautifying the landscape are only a few of the benefits. Song birds are attracted to trees and shrubs to make their homes, and other wildlife seek this cover for protection. In short, trees make any place a better place to live.

This part of the report deals with suitability and limitations of the soils for growing trees and shrubs. Trees vary in their response to different soils and should be selected accordingly. Table 6 shows most of the species that have value for home and recreational use for this area. They are rated according to how they can be expected to grow on the individual soils of the area. Landscape specialists should be consulted for selection of species, arrangement, and location of plantings.

Tree and Shrub Suitability Groups

The individual soils have been placed into five broad suitability groups for tree and shrub production. Each group consists of soils that are nearly alike in those characteristics that determine their suitability for growing trees or shrubs. Table 6 shows shrub and tree species adapted to the area and their relative suitability within each of the five soil groups.

Group 1. Soils in this group are the most desirable for growing trees and shrubs.

Da Devon
Db Devon
Dc Devon
Dd Devon
Eb Ethridge
Hd Devon loam portion only

Group 2. These soils are less desirable for growing trees and shrubs than soil in Group 1. These soils have more clay and are slowly permeable.

Pa Poser
Pb Poser, moderately well drained variant
Ea Emmer loam portion only

Group 3. Soils in this group are poorly drained and the water table affects species adaptation.

Ra Rista
Rb Rista, wet phase

Group 4. Soils in this group are strongly alkaline or have high lime content that are severe limitations for growing shrubs and trees.

Aa Absher
Ab Absher
De Devon, alkali variant
Df Devon, alkali variant
Hd Hill loam portion
Hc Hill
Pa Kerwin portion

Group 5. Soils in this group are strongly alkaline and poorly drained and have very severe limitations for growing shrubs and trees.

Ha Hagga
Hb Hagga, saline phase
Ia Ideon
Ib Ideon, alkali variant
Ic Ideon, sandy substratum

Where the soils are suitable, most trees and shrubs will respond favorably to irrigation if good quality water is available. Plantings should receive sufficient water to moisten the soil to a depth of 6 feet. Infrequent irrigations will help to control weeds and encourage deep rootings of trees and shrubs. It is desirable to withhold irrigation water in late summer to permit trees to harden before frost. August 1 is suggested as the last irrigation of these soils. A late fall application of irrigation water just before freezeup is very beneficial to trees if the soil is dry. This is especially true for evergreens.

Table 6. Shrub and Tree Adaptations Rating by Soil Group

Shrubs and Trees	Soil Suitability Group				
	Group 1	Group 2	Group 3	Group 4	Group 5
Shrubs					
Caragana	1	3	4	2	4
Skunkbush sumac	1	3	4	3	4
Tatarian honeysuckle	1	3	3	3	4
Lilac, common	1	2	2	4	4
Chokecherry	1	3	4	4	4
American plum	1	3	4	4	4
Purple willow	4	4	1	4	3
Buffaloberry, common	2	4	2	2	3
Sandcherry	1	4	4	4	4
Nanking cherry	1	4	4	4	4
Redosier Dogwood	3	4	1	4	3
Cotoneaster, Peking	3	3	3	4	3
Salttree, Siberian	4	4	3	2	3
Trees--low form					
Russianolive	1	2	2	2	2
Siberian crabapple	2	2	3	4	4
Trees--tall form					
Green ash	1	2	3	2	3
American elm	4	4	4	4	4
Siberian elm	1	3	3	4	4
White willow	4	2	1	4	2
Golden willow	4	2	1	4	2
Cottonwood, Siouxland	4	3	1	4	3
Birch, water	4	3	2	4	4
Trees--evergreens					
Scotch pine	1	2	4	4	4
Ponderosa pine	1	2	4	4	4
Colorado blue spruce	1	3	3	4	4
Rocky Mountain juniper	1	2	2	3	2

Adaptability Ratings: 1 - Good; 2 - Fair; 3 - Poor; 4 - Not Suited

SECTION III. SOIL LIMITATIONS FOR COMMUNITY DEVELOPMENT AND INTERPRETIVE MAPS

Planning is essential in today's changing and expanding communities. An increasing population coupled with greater mobility, more leisure time, and higher standards of living, all point to the need for sound land use decisions in community planning and development. Basic soils information that can be interpreted from the soil survey is fundamental for making sound decisions on land use. Community plans based on soil facts and proper land use are vital to the economic and prosperous growth of any community.

This section contains soil interpretation tables and maps that can be used by planning commissioners, planning consultants, city officials, and others in making land use decisions for the community of Big Sandy.

The information contained in Table 7 enables the user to find the most desirable soil area for the following uses.

1. Residential development with public sewage disposal
2. Roads and parking areas
3. Lawns and landscaping
4. Intensive play areas
5. Picnic areas
6. Cemeteries
7. Sanitary land fills
8. Septic tank filter fields
9. Sewage lagoons

In making soil interpretations for these uses, the soils are rated in terms of the degree of limitation--slight, moderate, and severe. By assigning a limitation rating to each kind of soil, we are indicating the severity of the problems expected to be encountered. This does not mean the problems cannot be overcome at a cost. The decision of whether a soil will be used for a specific purpose regardless of its limitations for that use must be made by the land use planners and developers.

In addition to information contained in Table 7 for these nine kinds of land uses for community development, corrosivity ratings of soils are shown on the map on page 67 of this section.

The information contained in this section is not intended to eliminate the need for on-site investigation and study to determine specific locations for the installation of a facility.

Three degrees of soil limitations are defined as:

1. None to slight (colored green on the interpretive maps): These soils have few, if any, limitations for use that cannot be readily overcome.

2. Moderate (colored yellow on the interpretive maps): These soils have one or more characteristics which impose moderate limitations for its use. To correct or overcome these limitations will increase the installation and maintenance cost.

3. Severe (colored red on the interpretive maps): These soils have one or more characteristics which impose serious limitations for its use. To correct or overcome these limitations will be costly and in some cases the cost may be prohibitive.

Flooding is one of the primary hazards affecting residential development in the Big Sandy community. The flood plain of Big Sandy Creek is frequently covered with water from spring runoff and sometimes by heavy rains. Fortunately there has been no housing development in this area.

Figure 7. The Hagga, Ideon and Rista soils were all flooded from the overflow of Big Sandy Creek during the 1964 flood. Photo by Clarence Baxter.

Table 7. Soil Limitation Ratings for Community Development in Big Sandy, Montana

Soil Series Names (1)	Residential Development (2)	Roads & Parking (3)	Lawns and Landscaping (4)	Intensive Play Areas (5)	Picnic Areas (6)	Cemeteries (7)	Sanitary Land Fill (8)	Sewage Disposal	
								Septic Tank (9)	Lagoons (10)
Absher soils	Severe	Severe	Moderate	Moderate	Moderate	Moderate	Severe	Severe	Slight
Devon soils	Slight	Severe	Slight	Moderate	Moderate	Slight	Moderate	Slight	Moderate
Devon, alkali variant	Severe	Severe	Severe	Moderate	Moderate	Slight	Moderate	Severe	Slight
Emmer soils	Severe	Severe	Severe	Moderate	Moderate	Severe	Severe	Severe	Slight
Ethridge Soils	Severe	Severe	Severe	Moderate	Moderate	Severe	Severe	Severe	Slight
Hagga soils	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Moderate
Hill soils--(slopes 3-8%)	Slight	Moderate	Slight	Moderate	Moderate	Slight	Moderate	Moderate	Severe
(slopes 8-15%)	Moderate	Moderate	Moderate	Severe	Moderate	Moderate	Moderate	Severe	Severe
Ideon soils	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Slight
Kerwin soils	Severe	Severe	Severe	Moderate	Moderate	Severe	Severe	Severe	Slight
Lobe soils	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Slight
Poser soils	Severe	Severe	Severe	Moderate	Moderate	Severe	Severe	Severe	Slight
Poser, moderately well drained variant	Severe	Severe	Moderate	Moderate	Moderate	Severe	Severe	Severe	Slight
Rista soils	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Moderate
Tinsley soils	Moderate	Moderate	Moderate	Severe	Moderate	Moderate	Moderate	Severe	Severe

Soil Ratings for Residential Development With Public Sewage Disposal

This interpretation indicates the degree of soil limitation for the construction and maintenance of homes and small buildings less than three stories high and having basements.

Soils are important in the construction and maintenance of buildings. The cost of excavation, bearing strength of the soil supporting the foundation, soil drainage, both surface and internal, flood hazard, salts, shrink-swell behavior of clay, topography, and depth to rock are all important factors to consider when subdividing lands for urban development.

Soil characteristics affecting building sites in residential developments are: shrink-swell behavior, depth to seasonal high water table, flood hazard, steepness of topography, depth to rock, amount of stone, and salinity or alkalinity. In the following table, each of these characteristics is rated as to degree of limitation affecting use. The soil property giving the highest degree of limitation is used to rate the soil as slight, moderate, or severe for this kind of land use.

Table of Soil Limitations for
Building Sites in Residential Developments With Public Sewage Disposal

Limiting Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
Shrink-swell behavior	Low	Moderate	High
Depth to seasonal high water table 2/	> 72" [redacted]	36 to 72"	Less than 36"
Flood hazard 1/	Never	Never	More often than once in 50 years
Slope	0 to 8%	8 to 15%	More than 15%
Depth to bedrock	More than 60"	36 to 60"	Less than 36"
Stoniness or rockiness	Stony	Very stony	Extremely stony
Salinity or alkalinity (salts)	Slight	Moderate	Strong

1/ Any area subject to flooding more often than once in 50 years has severe limitation for residential use.

2/ Residential development without basement would have less severe restriction for water table and depth to rock.

Soil mapping units having only slight limitations for residential use are: Da, Db, Dc, Dd, Hd.

Soil mapping units having moderate limitations for residential development and factors affecting use are:

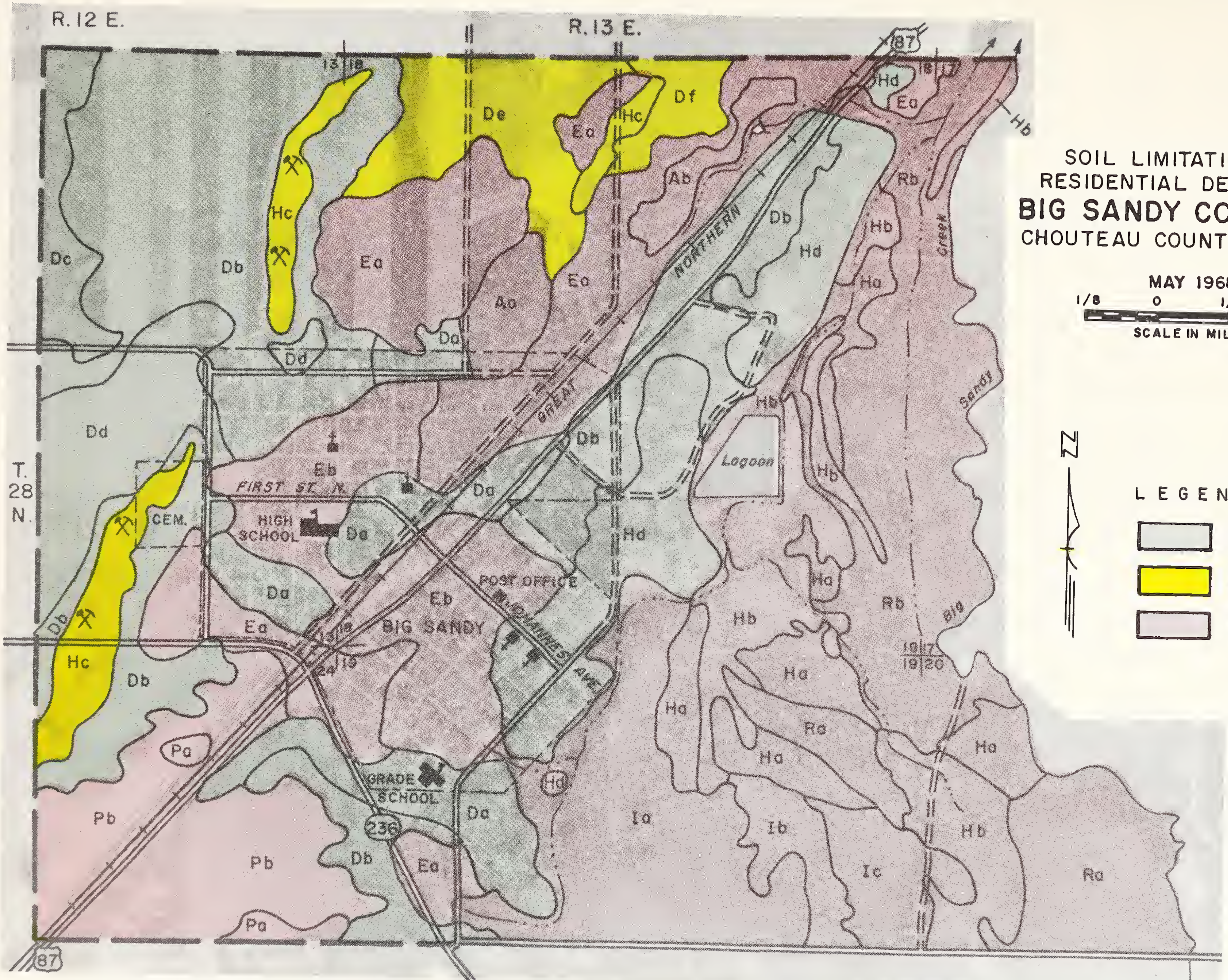
De Salinity and alkalinity, and moderate shrink-swell
Df Salinity and alkalinity, and moderate shrink-swell
Hc Moderately steep slopes

Soil mapping units having severe limitations for residential development and factors affecting this use are:

Aa High shrink-swell, alkalinity, and occasional flooding
Ab High shrink-swell, alkalinity, and occasional flooding
Ea high shrink-swell, alkalinity, and occasional flooding
Eb Frequent flooding
Ha Frequent flooding, and water table
Hb Frequent flooding, water table, and salinity and alkalinity
Ia Frequent flooding, shrink-swell, and water table
Ib Frequent flooding, shrink-swell, water table, and alkalinity
Ic Frequent flooding, and water table
Pa Frequent flooding and high shrink-swell
Pb Occasional flooding, and shrink-swell
Ra Frequent flooding, and water table
Rb Frequent flooding, and water table

SOIL LIMITATIONS FOR RESIDENTIAL DEVELOPMENT
BIG SANDY COMMUNITY
CHOUTEAU COUNTY, MONTANA

MAY 1968



U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE
USDA-SCS-PORTLAND, OREG. 1968

Soil Ratings for Roads and Parking Areas

This interpretation indicates the degree of soil limitation for the construction and maintenance of roads and parking areas in the Big Sandy community.

Soil properties influencing construction and maintenance costs are: depth to water table, flooding hazard, load-bearing capacities (AASHO rating), frost heave potential, stoniness, depth to rock, and topography.

The following table lists these soil characteristics and indicates the degree of limitation applied to the range of each property.

Table of Soil Limitations for Community Roads and Parking Areas

Limiting Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
Depth to high water table	Below 36"	20 to 36"	Less than 20"
Flooding hazard	No more than once in 10 yrs.	No more than once in 5 yrs.	More than once in 5 years
Load-bearing capacity (AASHO rating)	A-1 to A-3	A-4 to A-5	A-6 to A-7
Frost heave potential	Low	Moderate	High
Stoniness	Very stony	Extremely stony	Stony land or rubble
Depth to rock	Below 36"	20 to 36"	Less than 20"
Topography (slope range)			
for parking	0 to 3%	3 to 8%	Over 8%
for roads	0 to 8%	8 to 15%	Over 15%

Other properties unique to a particular soil quality which may affect its use for roads and parking are high shrink-swell and erodibility.

There are no soils in the area that have only slight limitations for use as roads or parking.

Soil mapping units having moderate limitation for roads and parking and factors affecting this kind of use are:

Hc Steepness of slope
Hd Bearing capacity, frost heave, and slope

Soil mapping units having severe limitation for roads and parking and factors affecting this use are:

Aa Low bearing capacity, and high frost heave
Ab Low bearing capacity, and high frost heave
Da Low bearing capacity and high frost heave
Db Low bearing capacity and high frost heave
Dc Low bearing capacity and high frost heave
Dd Low bearing capacity and high frost heave
De Low bearing capacity and high frost heave
Df Low bearing capacity and high frost heave
Ea Low bearing capacity and high frost heave
Eb Low bearing capacity and high frost heave
Ha Frequent flooding and high frost heave
Hb Frequent flooding and high frost heave
Ia Frequent flooding, low bearing capacity, and high frost heave
Ib Frequent flooding, low bearing capacity, and high frost heave
Ic Frequent flooding, low bearing capacity, and high frost heave
Pa Low bearing capacity, and high frost heave
Pb Low bearing capacity
Ra Frequent flooding, and high frost heave
Rb High water table, frequent flooding, and high frost heave

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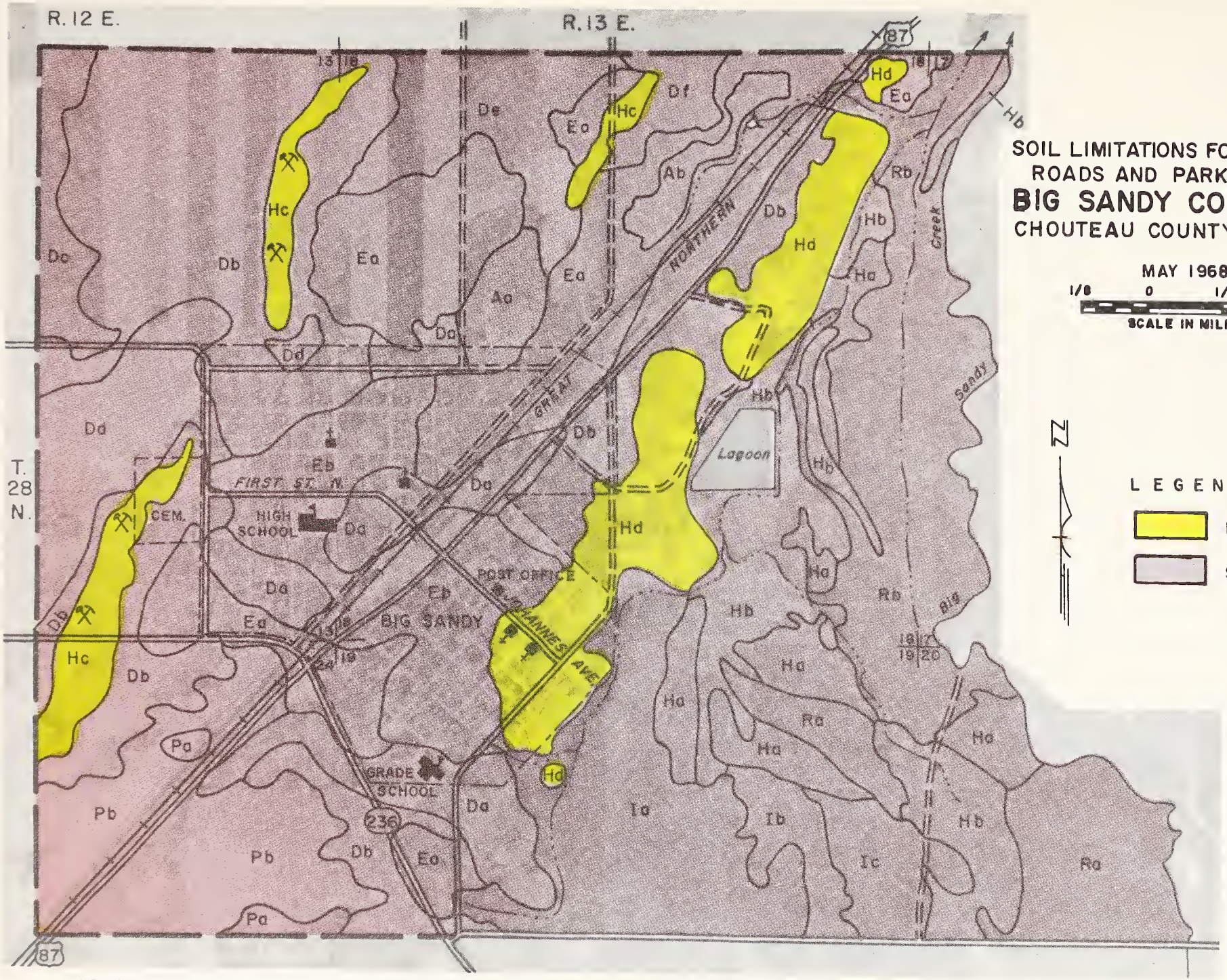

SOIL LIMITATIONS FOR COMMUNITY ROADS AND PARKING AREAS

BIG SANDY COMMUNITY

CHOUTEAU COUNTY, MONTANA

MAY 1968

1/8 0 1/8 1/4

SCALE IN MILES

N

LEGEND

Moderate

Severe

ADVANCE COPY - SUBJECT TO CHANGE

Soil Ratings for Lawns and Landscaping

This interpretation indicates the degree of soil limitation for lawns and landscaping. The soil is rated on the assumption it will be used for lawn turf, shrubs, and trees, without the need for adding topsoil for good establishment and also that irrigation is provided.

A lawn turf should withstand a moderate amount of foot traffic in addition to controlling soil erosion from runoff.

Soil characteristics affecting this use are depth to seasonal high water table, slope, depth to bedrock, stoniness, soil texture (surface), flood hazard, and salts. The following table lists these properties and gives the degree of limitation for the range of each property. The soil characteristic giving the highest limitation is used to rate the soil as slight, moderate or severe.

Table of Soil Limitations for Lawns and Landscapes

Limiting Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
Depth to seasonal high water table	Below 20"	6 to 20"	Less than 6"
Slope 1/	0 to 8%	8 to 15%	More than 15%
Depth to bedrock	More than 36"	20 to 36"	Less than 20"
Stoniness	Nonstony to stony	Very stony	Extremely stony to stony land
Soil texture 2/ of the surface 6 inches	Sandy loams, loams, silt loam with up to 50% gravel	Silt, silty clay loam, sandy clay loam, clay loam with up to 50% gravel	Sand, loamy sands, silty clay, clay, muck or peat.
Flood hazard	None to seldom	Occasional	Frequent
Salinity or alkalinity of surface 12 inches	Low	Moderate (pH 8.5 to 9.0)	High (pH over 9.0)

1/ Slopes greater than 15 percent are difficult to mow and they have a high erosion hazard during turf establishment.

2/ Soil which forms a hard crust on drying is rated one degree higher in severity of the problem, except for silty clay and clay which remain as severe because of texture.

Soil mapping units having only slight limitations for lawns and landscaping are: Da, Db, Dc, Dd, and Hd.

Soil mapping units having moderate limitations and factors affecting this use are:

Aa (Absher portion only) Occasional flooding and surface texture
Ab (Absher portion only) Occasional flooding and surface texture
Hc Slopes up to 15 percent
Pb Occasional flooding, and crusty surface

Soil mapping units having severe limitations and factors affecting this use are:

Aa (Devon, alkali variant) High salinity
Ab (Noble portion only) Clay surface and high salinity
De High salinity
Df High salinity
Ea Frequent flooding and surface crusting
Eb Frequent flooding
Ha Frequent flooding
Hb Frequent flooding and high salinity
Ia Frequent flooding and surface crusting
Ib Frequent flooding, high salinity and alkalinity, and surface crusting
Ic Frequent flooding, clay texture, and surface crusting
Pa Frequent flooding and crusty surface
Ra Frequent flooding
Rb Frequent flooding and poor drainage

Soil Ratings for Intensive Play Areas

This interpretation indicates the degree of soil limitation for areas developed for playgrounds and organized games such as baseball, football, volleyball, and running. They are subject to much foot traffic and require smooth, nearly level to gentle slopes. In general, areas need not be larger than two acres in size. Soils should be capable of supporting and maintaining a grass cover if desired.

Soil characteristics affecting this kind of use are slope, water table, flood hazard, surface texture to a depth of six inches, depth to hard rock, stoniness, and soil erodibility. The following table lists these properties and gives the degree of limitation applied to each. The soil characteristic giving the highest limitation is used to rate the soil as slight, moderate, or severe.

Table of Soil Limitation for Intensive Play Areas

Limiting Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
Slope	0 to 5%	5 to 10%	Over 10%
Depth to high water table	Below 36"	12 to 36"	Less than 12"
Flood hazard	No flooding during period of heavy use	Occasional flooding during period of heavy use	Frequent flooding during period of heavy use
Surface texture to 6 inches	Coarse, loamy	fine loamy or fine silty	Clayey or sandy 1/ and peat or muck
Depth to hard rock	Below 20"	10 to 20"	Less than 10"
Stoniness	None	Occasional	Very stony
Soil erodibility	Slight or moderate	Severe	Very severe

1/ Sandy textures are ideal for some types of intensive play such as beaches where they remain moist. They are usually too loose (when dry) for good footing for competitive sports.

There are no soils in the area that have only slight limitations for use as intensive play areas.

Soil mapping units having moderate limitations for intensive play and factors affecting this use are:

Aa Soil texture, occasional flooding, and slopes
Da Soil texture affecting water intake rate
Db Soil texture affecting water intake rate
Dc Soil texture and slope
Dd Soil texture affecting water intake rate
De Soil texture affecting water intake rate
Df Soil texture affecting water intake rate
Ea Soil texture and occasional flooding during heavy use period
Eb Soil texture and occasional flooding during heavy use period
Hd Soil texture and slope
Pa Soil texture and occasional flooding during heavy use period
Pb Soil texture and occasional flooding during heavy use period

Soil mapping units having severe limitations for intensive play areas, and factors affecting this use are:

Ab Clay surface, and slow water intake rate
Ha Flooding and poor drainage
Hb Flooding and poor drainage
Hc Steepness of slope
Ia Frequent flooding and poor drainage
Ib Frequent flooding, clay texture, and poor drainage
Ic Frequent flooding, clay texture, and poor drainage
Ra Frequent flooding, and poor drainage
Rb Frequent flooding, and poor drainage

Soil Ratings for Picnic and Play Areas

This interpretation indicates the degree of soil limitations for picnic and play areas. The areas should provide adequate space for limited running or unorganized games, picnic tables and fireplaces. Soils should be capable of supporting and maintaining trees and grass under this use, with very little site preparation needed. The landscape for the site should be attractive.

Soil characteristics affecting this use include depth to seasonal high water table, flood hazard during period of heavy use, soil texture of the surface six inches, slope, stoniness, and inherent erodibility. The following table lists these properties and gives the degree of limitation for the range of each property. The soil characteristic giving the highest limitation is used to rate the soil as slight, moderate, or severe.

Table of Soil Limitation for Picnic and Play Areas 1/

Limiting Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
Depth to Seasonal high water table	Below 36"	18 to 36"	Less than 18"
Flood hazard (during heavy use)	Never or seldom	Occasional	Frequent
Soil texture (surface 6 inches)	Sandy or coarse loamy	Fine silty or fine loam	Clay, peat, or muck
Slope	Less than 8%	8 to 20%	Over 20%
Stoniness	None to very stony	Extremely stony	Rubble
Inherent erodibility	Slight to moderate	Severe	Very severe

1/ The need for water supply and sewage disposal problems are not considered in these ratings.

There are no soils in the area that have only slight limitation for use as picnic or play areas.

Soil mapping units having moderate limitations for picnic and play areas and factors affecting this use are:

Aa Soil texture and occasional flooding
Da Soil texture
Db Soil texture
Dc Soil texture
Dd Soil texture
Df Soil texture
Ea Soil texture
Eb Soil texture and occasional flooding
Hc Slope
Hd Soil texture
Pa Soil texture and occasional flooding
Pb Soil texture and occasional flooding

Soil mapping units having severe limitations for picnic and play areas and factors affecting this use are:

Ha Frequent flooding and poor drainage
Hb Frequent flooding and poor drainage
Ia Frequent flooding and poor drainage
Ib Frequent flooding, clay texture and poor drainage
Ic Frequent flooding, clay texture, and poor drainage
Ra Frequent flooding and poor drainage
Rb Frequent flooding and poor drainage

Soil Ratings for Cemeteries

This interpretation indicates the degree of soil limitation for community type cemeteries. The soil properties should permit excavation for grave sites to a depth of six feet during all seasons of the year. It is assumed the top soil excavated at the site will be reused as topsoil for lawn turf establishment.

Soil characteristics affecting cemeteries are seasonal high water table, flooding hazard, depth to hard rock, slope, stoniness and soil texture of the surface 6 inches. The following table lists these factors and indicates the degree of limitation applied to each range of the soil property. The property giving the highest degree of limitation is used to rate the soil as slight, moderate or severe.

Table of Soil Limitations for Cemeteries

Limiting Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
Seasonal High water table	Below 7 feet	5 to 7 feet	Less than 5 feet
Flooding hazard	Never	Occasional	Frequent
Depth to hard rock	Below 6 feet	Below 6 feet	Less than 6 feet
Slope	0 to 8%	8 to 15%	Over 15%
Stoniness	Nonstony	stony	Very stony
Surface texture to 6 inches 1/	Coarse loamy	Fine loamy	Sandy or clayey

1/ The surface 6 inches of soil may contain up to 50 percent gravel or cobble in the coarse loamy or fine loamy textural groups.

Soil mapping units having only slight limitations for use as cemeteries are: Da, Db, Dc, Dd, De, Df, and Hd.

Soil mapping units having moderate limitations for cemeteries and factors affecting their use are:

Aa Occasional flooding and fine loamy surface
Ac Slope
Pb Occasional flooding and fine loamy surface

Soil mapping units having severe limitations for cemeteries and factors affecting this use are:

Ab Clay texture and high alkalinity
Ea Frequent flooding
Eb Frequent flooding
Ha Frequent flooding and high water table
Hb Frequent flooding and high water table
Ia Frequent flooding and high water table
Ib Frequent flooding and high water table
Ic Frequent flooding and high water table
Pa Frequent flooding
Ra Frequent flooding and high water table
Rb Frequent flooding and high water table

Soil Ratings for Sanitary Land Fills

This interpretation indicates the degree of soil limitation for sanitary land fills. They are disposal areas for trash and garbage. The soils are rated for the trench method of land-fill construction with hauling of cover material unnecessary. A good sanitary land fill should operate without contaminating water supplies, reducing aesthetic land values, or causing health hazards. In addition, they should be usable during all easons of the year. Fill areas that have been adequately compacted and covered can be used for parking areas, parks, recreation areas, industrial sites, and many other valuable uses.

Soil factors considered in rating the limitations for use are seasonal high water table, permeability, slope, depth to bedrock, stoniness, surface texture, and flood hazard. The following table lists these factors and indicates the degree of limitation applied to each range of the soil property. The one giving the highest degree of limitation is used to rate the soil as slight, moderate, or severe.

Table of Soil Limitations for Sanitary Land Fills

Limiting Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
Depth to seasonal high water table 1/	Deeper than 10' below surface	6 to 10' below surface	Less than 6' below surface
Permeability	More than .63"/hr.	.20 to .63"/hr	Less than .20"/hr.
Slope	0 to 8%	8 to 15%	15+%
Depth to bedrock 2/	More than 6'	4 to 6'	Less than 4'
Stoniness	Nonstony to stony	Very stony	Extremely stony to rubble land
Excavated soil texture	Sandy and coarse-loamy, up to 50% gravel	fine-loamy or fine-silty, up to 50% gravel	Clayey texture or peat or muck
Flood hazard 3/	Seldom	Occasional	Frequent

1/ Seasonal high water table will prevent proper land-fill operations during certain seasons and seepage can cause contaminated liquids to flow out on the lower banks.

2/ This is depth to hard unrippable bedrock, and on-site investigation should be made to determine actual depth to bedrock.

3/ This is an estimate of dominate condition, and on-site investigation to determine actual overflow frequency should be made.

Current Montana Department of Health regulations for Sanitary Land Fill should be followed.

There are no mapping units having only slight limitations for sanitary land fills.

Soil mapping units having moderate limitations for sanitary land fills and factors affecting this use are:

Da Fine loamy textures and moderately slow permeability
Db Fine loamy textures and moderately slow permeability
Dc Fine loamy textures and moderately slow permeability
De Fine loamy textures and moderately slow permeability
Df Fine loamy textures and moderately slow permeability
Hc Steepness of slopes
Hd Fine loamy texture and moderately slow permeability

Soil mapping units having severe limitations for sanitary land fills and factors affecting this use are:

Aa Clay textures and slow permeability
Ab Clay textures and slow permeability
Ea Clay textures, slow permeability and flooding
Eb Frequent flooding
Ha Frequent flooding, poor drainage and underlying clay
Hb Frequent flooding, poor drainage and underlying clay
Ia Frequent flooding, poor drainage and clay texture
Ib Frequent flooding, poor drainage and clay texture
Ic Frequent flooding, poor drainage and clay texture
Pa Frequent flooding, clay texture and slow permeability
Pb Clay texture and slow permeability
Ra Frequent flooding and poor drainage
Rb Frequent flooding and poor drainage

Soil Ratings for On-Site Sewage Disposal Fields (Septic Tank)

This interpretation indicates the degree of soil limitation for on-site sewage disposal. The most common on-site sewage disposal used in areas where central sewage systems are unavailable is the septic tank system. The well designed system consists of a septic tank for holding solid wastes, a distribution box for dispensing effluent, and a tile disposal field. Successful operation of the entire system depends on the ability of the soil to absorb and filter the liquid or effluent passed through the tile field. It is in the soil where effluent purification takes place. The presence of a soil characteristic which impairs proper absorption and filtering of the effluent will cause health hazards as well as public nuisance situations in smaller lots.

Soil characteristics affecting the operation of the tile disposal field include permeability rates, depth to bedrock, depth to seasonal high water table, slope, stoniness, and flood hazard. The following table lists these and indicates the degree of limitation applied to each range of soil properties. The soil property or characteristic giving the highest degree of limitation is used to rate the soil as slight, moderate, or severe.

Table of Soil Limitation for on-Site Disposal Systems

Limiting Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
Soil Permeability rate	More than 1 in/hr 1/	.63 to 1 in/hr	Less than .63 in/hr
Depth to Bedrock 2/	More than 6'	4 to 6'	Less than 4'
Seasonal High Water Table	More than 6' below surface	3 to 6' below surface	Less than 3' below surface
Slope	0 to 5%	5 to 10%	Over 10% 3/
Stoniness	Stony to very stony	Very stony	Extremely stony to stony land
Flooding	Never	Never	Occasional to frequent

1/ Possible pollution hazard to surface water and ground water supplies where permeability rates are rapid.
2/ Creviced, shattered or dissolved passageways in limestone bedrock may not adequately filter effluent and present a pollution problem.
3/ Slopes greater than 10 percent have severe limitations because unfiltered effluent may surface on the downhill slope.

Current Montana Department of Health standards for septic tank system design and installation should be followed where on-site disposal systems are planned.

The following mapping units have only slight limitations in their use for on-site sewage disposal fields: Da, Db, and Dd.

Soil mapping units having moderate limitations for sewage disposal fields and factors affecting this use are:

Dc Slope
Hd Slope

Soil mapping units having severe limitations for sewage disposal fields and factors affecting this use are:

Aa Slow permeability and occasional flooding
Ab Slow permeability and occasional flooding
De Slow permeability
Df Slow permeability
Ea Slow permeability and frequent flooding
Eb Frequent flooding
Ha Frequent flooding and high water table
Hb Frequent flooding and high water table
Hc Steep slopes
Ia Frequent flooding, high water table and slow permeability
Ib Frequent flooding, high water table and slow permeability
Pa Frequent flooding and slow permeability
Pb Slow permeability and occasional flooding
Ra Frequent flooding and high water table
Rb Frequent flooding and high water table

Soil Ratings for Sewage Lagoons

This interpretation indicates the degree of soil limitation for sewage lagoons. A lagoon is a shallow lake used to hold sewage for the time required for bacteria decomposition. A suitable site should provide an impoundment area and enough soil material to make the dam structure. The completed lagoon must be able to hold water with minimum seepage and prevent contamination of water supplies. Other important factors to consider are locations of occupied buildings, prevailing winds, inflow hazard from adjacent slopes, and the characteristics of receiving streams. Final selection of the specific location will require on-site investigations.

Soil characteristics affecting sewage lagoons are permeability, slope, depth to bedrock, coarse fragments, stoniness, soil texture, and organic matter. The following table lists these factors and indicates the degree of limitation applied to each range of the soil property. The soil property giving the highest degree of limitation is used to rate the soil as slight, moderate or severe.

Table of Soil Limitations for Sewage Lagoons

Limiting Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
Permeability (basin floor)	Less than .63 in/hr	.63 in. to 2.0 in/hr	More than 2 in/hr 1/
Slope	0 to 3%	3 to 8%	Over 8%
Depth to bedrock	More than 5'	3' to 5'	Less than 3'
Coarse fragments less than 6" in dia.	0 to 20%	20 to 50%	Over 50%
Percent of surface covered by stones over 6inches in dia.	Less than 3%	3 to 15%	Over 15%
Soil texture or material 2/	GC, SC, CL, CH	GM, ML, SM, MH	GP, GW, SP, SW, OL, OH, PT
Organic Matter 3/	Less than 2%	2 to 15%	More than 15%

1/ Ground water may become contaminated by seepage through rapidly permeable fractured rock, open gravel, or cavernous limestone.

2/ This refers to the undisturbed soil underlying the embankment and impoundment in terms of the United Soil Classification System.

3/ This is based on organic matter content below the surface 18 inches. This assumes the top 18 inches of soil will be scraped from the lagoon site.

Current Montana Department of Health Standards for sewage lagoons should be followed.

The following mapping units have only slight limitations in their use for sewage lagoons: Ab, De, Ea, Eb, Ia, Ib, Pa, and Pb.

Soil mapping units having moderate limitations for sewage lagoons and factors affecting this use are:

Aa Moderate slope
Da Soil permeability
Db Soil permeability and slope
Dc Soil permeability and slope
Df Moderate slope
Ha Soil stratification affecting seepage
Hb Soil stratification affecting seepage
Ic Soil permeability and sandy texture
Ra Soil stratification affecting seepage
Rb Soil stratification affecting seepage, high water table

Soil mapping units having severe limitations for sewage lagoons and factors affecting this use are:

Hc Steep slopes and rapid permeability
Hd Steepness of slope

Soil Ratings for Corrosivity of Untreated Steel that is in Contact With Soil

This interpretation indicates the degree of soil limitation that affects the corrosion of uncoated steel when buried in the soil. This is a physical-biochemical process which converts iron into ions through an oxidation and reduction process. Soil moisture is needed to form solutions with soluable salts in an environment having differential concentration before the oxidation-reduction process can operate. This constitutes what is known as a corrosion cell. Some of the soil factors affecting corrosivity are moisture content, soil permeability, conductivity of soil solution, hydrogen ion activity of soil solution (pH), soil aeration, activity of soil organisms causing oxidation-reduction reactions. The corrosivity of soil is commonly determined by (1) electrical resistivity or resistance to a flow of current, (2) total acidity which is roughly equal to the extractable acidity and not necessarily related to pH of the soil, (3) soil drainage (fluctuating water tables), and (4) soil texture.

Soil factors considered in rating the limitation for this use are soil drainage, soil permeability, soil texture, total acidity, soil resistivity and soil conductivity. The following table lists these factors and indicates the degree of limitation applied to each range of property. The one giving the highest degree of limitation is used to rate the soil as slight, moderate or severe. The rating is based on the assumption the pipe or metal will be buried at depths between 10 and 40 inches. If the pipe or metal is to be located at some other depth, the rating does not apply.

Table of Soil Limitation for Untreated Metal (Corrosivity for Steel)

Limiting Factors affecting use	Degree of Limitation		
	Slight	Moderate	Severe
Soil drainage (class)1/	Well to excessive	Well and moderately well	Imperfectly to poorly
Soil permeability (inches per hour)	More than .63	0.2 to 6.3	Less than 0.2
Soil texture group	Sandy and coarse loamy	Fine-silty and fine-loamy	Clayey, peat or muck
Total acidity (Meg/100 grams soil)	Less than 8	8 to 11	More than 12
Soil Resistivity at Moisture Equivalent (ohms per cm)	More than 5000	2000 to 5000	Less than 2000
Soil conductivity (mmho per cm @ 25°C)	Less than 0.2	0.2 to 0.5	more than 0.5

1/ The drainage class may vary with soil texture and fluctuating water table. Usually soils with permanent high water tables are less corrosive than those that fluctuate.

There are no soils in the area that have only slight limitation for corrosion of untreated steel when buried in soil.

The following mapping units have moderate limitations that affect the corrosivity of untreated steel when buried in the soil.

Da Moderately fine textures and strong alkalinity
Db Moderately fine textures and strong alkalinity
Dc Moderately fine textures and strong alkalinity
Dd Moderately fine textures
Eb Moderately fine textures and strong alkalinity
Hc Moderately fine textures except for Tinsley portion.
Hd Moderately fine textures.

The following mapping units have severe limitations that affect the corrosivity of untreated steel when buried in the soil.

Aa Fine textured soil, permeability, and high salt content
Ab Fine textured soil, permeability, and high salt content
De High salt content in the subsoil
Df High salt content in the subsoil
Ea Fine textured soil, permeability, and high salt content
Ha Fluctuating water table, high salts, and clay substrata
Hb Fluctuating water table, high salts, and clay substrata
Ia Fluctuating water table and fine textures
Ib Fluctuating water table, high salts and fine texture
Ic Fluctuating water table and high salts
Pa Fine textures and temporary flooding
Pb Fine textures and high salts
Ra Fluctuating water tables
Rb Fluctuating water tables, and clay substrata

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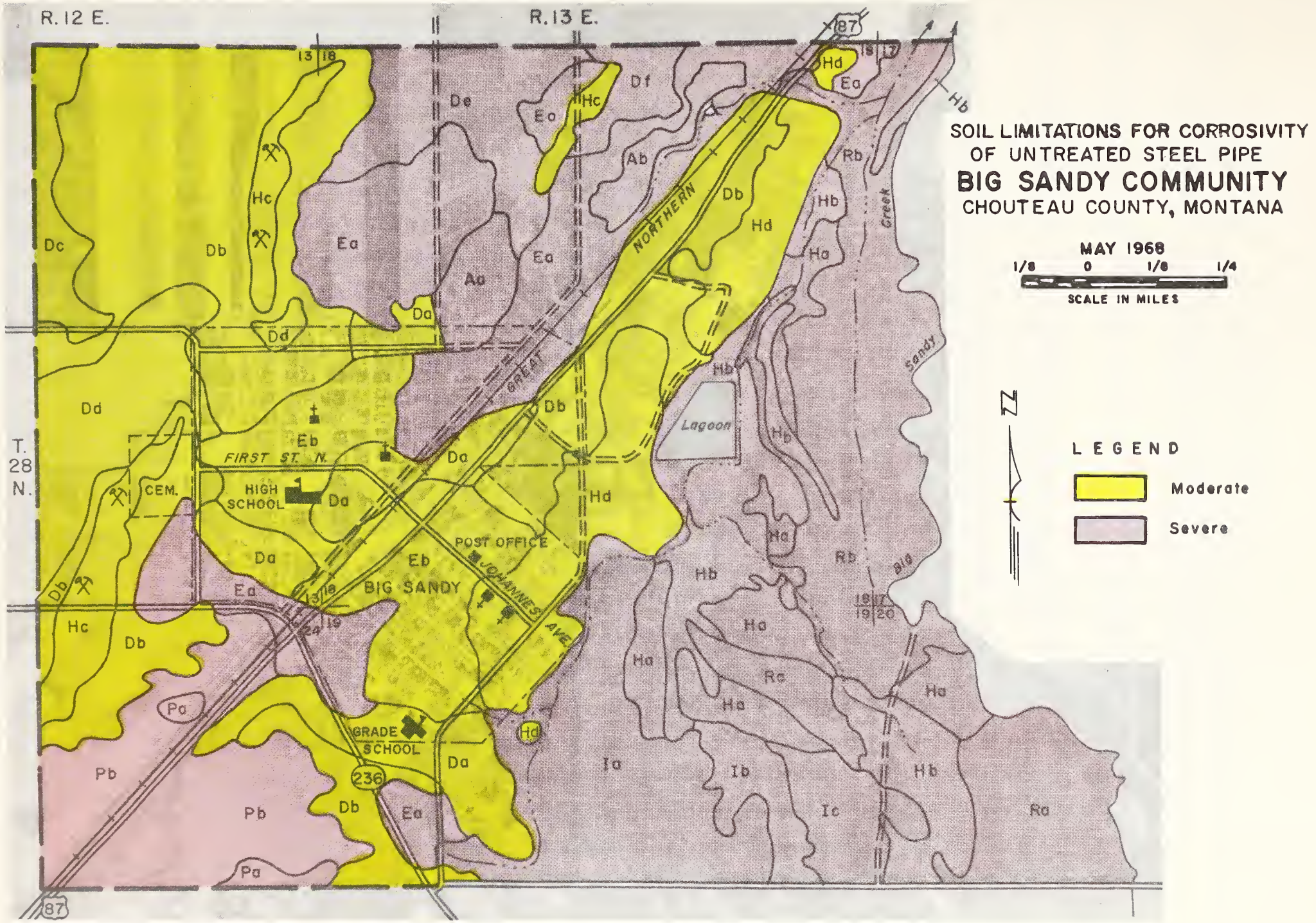

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G L O S S A R Y

AASHO System - A system for classifying the engineering properties of soils based on the American Association of State Highway Officials' system.

Aeration, Soil - The process by which air and other gases in the soil are renewed.

Aggregate, Soil - A single mass or cluster of soil consisting of many primary soil particles (sand, silt, clay).

Alluvial Soil - Soil developed from relatively recently deposited materials, transported by flowing water.

Available Water Capacity (AWC) - The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Bearing Strength - This is the load supporting capacity of a soil.

Calcareous Soil - Soil containing sufficient calcium carbonate to effervesce visibly when treated with 0.1 normal hydrochloric acid.

Clay -

a. As a soil separate, the mineral soil particles less than .002 millimeters in diameter.

b. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clayey - Soil texture containing more than 35 percent clay.

Coarse-loamy - Soil texture containing less than 18 percent clay and more than 15 percent coarser than very fine sand.

Complex, Soil - A mapping unit composed of two or more soils that are mingled in such an intricate pattern or in such small individual areas that they cannot be shown separately on a published soil map.

Consistence, Soil - The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose - Noncoherent; will not hold together in a mass

Friable - When moist, crushes easily under thumb and forefinger and can be pressed together into a lump.

Firm - When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Hard - When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Very hard - When dry, very resistant to pressure; cannot be broken between thumb and forefinger.

Soft - When dry, breaks into powder or individual grains under slight pressure.

Plastic - When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky - When wet, adheres to other material; tends to stretch somewhat and pull apart rather than pull free from other material.

Corrosion Potential - A rating based on the drainage, conductivity, texture, acidity, and alkalinity of the soil which indicates how rapidly untreated metal or concrete buried in the soil will corrode.

Depth, Soil - The depth in inches from the surface to a root-impeding layer in the soil. The following classes are used to express soil depth.

Deep - more than 40 inches deep

Moderately deep - 20 to 40 inches deep

Shallow - 10 to 20 inches deep

Very shallow - Less than 10 inches deep

Drainage, Soil - The rate or extent of removal of water from the soil. Seven classes of soil drainage are recognized as follows:

Very poorly drained - Water is removed from the soil so slowly that the water table remains at or near the surface the greater part of the time. Soils of this class usually occupy level or depressed sites and are frequently ponded.

Poorly drained - Water is removed from the soil so slowly that the soil remains wet for a large part of the time. The water table is commonly at or near the surface during a considerable part of the year.

Somewhat poorly drained - Water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time. Somewhat poorly drained soils commonly have a slowly permeable layer within the profile, a high water table, additions through seepage, or a combination of these conditions.

Moderately well drained - Water is removed from the soil somewhat slowly so that the profile is wet for a small but significant part of the time. Moderately well drained soils commonly have a slowly permeable layer within or immediately beneath the solum, a relatively high water table, additions of water through seepage, or some combination of these conditions.

Well drained - Water is removed from the soil readily but not rapidly. Well drained soils are commonly intermediate in texture although soils of other textural classes may also be well drained.

Excessively drained - Water is removed from the soil very rapidly. Excessively drained soils are commonly shallow, steep, or very coarse and porous.

Erosion Hazard - Relative susceptibility of the soil to the prevailing erosion agents of water and wind.

Fine-loamy - Soil textures containing more than 18 percent clay and less than 35 percent clay and more than 15 percent coarser than very fine sand.

Fine-silty - Soil textures containing more than 18 percent clay and less than 35 percent clay and less than 15 percent coarser than very fine sand.

Flood Plain - The nearly level areas along streams that are subject to overflow.

Glacial Drift - Material deposited after being transported by glacier ice, includes all deposits of a glacial origin made in glacial streams and lakes. The deposits may be stratified glacial outwash materials or unstratified deposits of till.

Glacial Till - That part of the glacial material deposited directly by the ice with little or no transportation by water.

Gravel - Rounded or partially rounded rock fragments two millimeters to three inches in diameter.

Horizon - A layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical, and biological properties or characteristics.

Infiltration - The downward entry of water into soil.

Internal Drainage - The downward movement of water through the soil profile. The rate of movement is affected by the texture, structure, and height of the ground water table, either permanent or perched.

Interpretation, Soil - The art and science of explaining the meaning or significance of basic soil information for alternative uses.

Lagoon - A lagoon is a shallow lake used to hold sewage for the time required for bacterial decomposition.

Liquid Limit - The moisture content at which a soil passes from a plastic to a liquid or fluid state.

Loam - A soil textural class having a relatively even mixture of sand, silt and clay.

Mapping Unit - It is composed of one or more soils having defined properties. Included are areas of other soils.

Microrelief - Minor surface irregularities of the land.

Mottled - Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage.

Parent Material - The rock or other geological materials from which a soil is formed.

Ped - An individual natural soil aggregate such as a crumb, a prism, or a block, in contrast to a clod.

Permeability - The rate at which water will move downward through a saturated soil. Terms used to describe relative classes of soil permeability in this report are as follows:

Class	Rate of Measurement Through Soil
Very slow	Less than 0.06 inches per hour
Slow	0.06 to 0.20 inches per hour
Moderately slow	0.20 to 0.63 inches per hour
Moderate	0.63 to 2.00 inches per hour
Moderately rapid	2.00 to 6.30 inches per hour
Rapid	6.30 to 20.0 inches per hour
Very rapid	More than 20.0 inches per hour

pH - A numerical expression of the acidity or alkalinity of the soil; the negative logarithm of the hydrogen-ion concentration. A pH of 7 denotes neutrality; less than 7 denotes an acid condition; and more than 7 denotes an alkaline condition in the soil.

Phase, Soil - A subdivision of a soil series, important to its use and management but not affecting its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in texture, slope, thickness, wetness, or some other characteristic that affects management.

Plastic limit - The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, Soil - A vertical section of the soil through all of its horizons, extending from the surface into the parent material.

Reaction - The degree of acidity or alkalinity of the soil, usually expressed as a pH value. The following reaction classes are recognized:

Extremely acid	pH less than 4.5
Very strongly acid	pH 4.5 to 5.0
Strongly acid	pH 5.1 to 5.5
Medium acid	pH 5.6 to 6.0
Slightly acid	pH 6.1 to 6.5
Neutral	pH 6.6 to 7.3
Mildly alkaline	pH 7.4 to 7.8
Moderately alkaline	pH 7.9 to 8.4
Strongly alkaline	pH 8.5 to 9.0
Very strongly alkaline	pH more than 9.0

Relief - The configuration or inequalities of the land surface which denote differences in elevation from one point to another in a given landscape.

Runoff - The removal of water by flow over the surface of the soil. The amount and rapidity of surface runoff are affected by the texture, structure, and porosity of the surface layer, by the vegetative covering, by the prevailing climate, and by the slope. The rate of surface runoff is expressed as follows: ponded, very slow, slow, medium, rapid, and very rapid.

Sand -

a. Individual rock or mineral fragments having diameters ranging from 0.05 millimeters to 2.0 millimeters. Sand grains consist chiefly of quartz but they may be of any mineral composition.

b. As a soil textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Series, Soil - A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the profile.

Silt -

a. Individual mineral particles of soil that range in diameter from 0.002 millimeters to 0.05 millimeters.

b. As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope - The rise or fall of the land surface measured in feet per hundred feet distance and expressed in percent.

Solum - That part of the soil profile, above the parent material, in which the processes of soil formation are taking place. In mature soils, this includes the A and B horizons, and the character of the material may be greatly unlike that of the parent material.

Structure, Soil - The aggregation of soil particles into clusters of particles, which are separated from adjoining aggregates by surfaces of weakness.

Subsoil - Commonly that part of the soil profile lying below the surface layer and the substratum.

Substratum - Any layer beneath the solum, or true soil; the C or R horizon.

Surface Soil - The soil ordinarily moved in tillage or its equivalent in uncultivated soil (about 5 to 8 inches in thickness).

Texture, Soil - The relative proportions of sand, silty and clay particles in a mass of soil. (See also clay, sand and silt.) The basic textural classes, in order of increasing proportions of fine particles are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay and clay. The sand, loamy sand and sandy loam classes may be further divided by specifying "coarse," "fine," and "very fine."

Topsoil - Usually darkest in color, highest in organic matter, and most fertile. Used to top-dress road banks, parks, lawns or gardens.

Unified System - A system developed by the U. S. Army, Corps of Engineers for classifying the engineering properties of soils.

Variant, Soil - A soil that has properties sufficiently different from those of other known soils to justify a new series name, but whose geographic area is so limited that creation of a new series is not believed justified.

Water Table - The upper surface of ground water, or the upper limit of the part of the soil or underlying material wholly saturated with water. In some places an upper or perched water table may be separated from a lower one by a relatively impervious dry zone.